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The Fair and the Future.

SEVERAL months ago at a London meeting of representative electrical authorities—but not for some reason or other open to the Press—the question of future policy of the industry with reference to exhibitions was under discussion, and as we were able to report at the time, a committee embracing all the various interests concerned was appointed to deliberate and report.

We are unaware whether the committee has yet met. Possibly the urgency of the subject was not considered to be such as to render expeditious action necessary. Certainly it is sometimes the case that policies form themselves under the influence of events more definitely than under the influence of discussion; and it may well be that what has been happening during the past few weeks at the British Industries Fair in Birmingham and in London has carried weight with some representatives and will not be without decisive effect when discussions eventually take place.

We believe that there is a general consensus of opinion amongst those whose judgment matters most that large electrical exhibitions such as took place at Wembley, Olympia, and Manchester, are only necessary at long intervals. We refer to exhibitions involving the erection of large plant, and lasting for prolonged periods. Conjoint action among manufacturers can ensure that any attempts by private parties to exploit the industry by promoting such shows shall be controlled. At the same time option must always rest with individual manufacturers regarding taking part in exhibitions of specialised industries in connection with which their own particular products have special application.

Another class of display—and one which must not be bound about with any jointly imposed restrictions—is that designed to popularise the applications of electricity in everyday life—domestic and small power work particularly. The Ideal Home Exhibition, which opens

on March 2nd, probably comes within this class, though the main electrical interest here, as last year, will be the combined domestic exhibit organised by the British Electrical Development Association and so popular with many thousands of the public. Local electrical exhibitions stand in a category by themselves as being desirable anywhere and at almost any time, though it is possible that these, if held with too great frequency, might involve a unity of policy on the part of some manufacturers. Electricity supply authorities which run permanent showrooms on enterprising lines as a definite part of their operations, have no need of special exhibition efforts apart from showroom activities; but even these showrooms must not be allowed to become too quiescent or somnolent—they must be so run as to maintain or stimulate the public interest; their existence must not be allowed to be forgotten. Co-operation between the electricity supply department, manufacturers, and local contractors should ensure success at such shows. Contractors may supplement these efforts by making their own shop windows more effectively impressive and demonstrative instead of letting them contain a general jumble of everything electrical and dropping the blinds or putting up the shutters at 7 o'clock at night when brightness would attract.

Then there are exhibitions such as we have at convention times—possibly these might be on a more ambitious scale. And some hold that if there is to be a big annual convention in future years with all departments of the electrical profession, industry, and trade taking part, the simultaneous holding of exhibitions, as in America, would be justifiable.

But whatever views may be in process of formation respecting any of the foregoing, there is no doubt that the future of the electrical industry in relation to the British Industries Fair is exercising many minds as the outcome of the successful operations which come to a close at Castle Bromwich, Birmingham, to-day. Various questions are being discussed. It is thought that the industry is now in a position to decide definitely in favour of co-operation at the Birmingham Fair for at any rate a specified number of years; that the response of manufacturers this year in so short a space of time may be regarded as a proof that many more firms will be prepared to take part, each in a small market shop form, next year; that this year's show can be made use of to increase the number of electrical overseas buyers next year because they will have heard of the excellence of this year's collection; that the wireless and other exhibits of a more or less electrical character that appeared in London this year should be transferred to Birmingham in future; in short, that Birmingham, with its vast hardware and metal trade collection, should be the place where every spring, colonial and foreign and home buyers could meet for a few weeks, perhaps a little longer than this year, with the certainty of finding a great market display of electrical manufactures, including apparatus, switchgear, cable, accessories, material, and so forth, and with the reasonable anticipation of meeting those who are competent to discuss their requirements with them.

We hardly think that there is any reason to doubt the majority feeling in regard to this matter, for as we have said already, it is to us unthinkable that the ever-growing electrical trade can be content with anything short of a magnificent business-getting demonstration among the other great trades of Great Britain. It would do us all good to have a regular trade fixture to look forward to and to put zest into. It need not be a costly matter for anybody.

Perhaps we shall have the satisfaction ere long of hearing whether the committee already mentioned holds views such as we have expressed, but from what we can learn from different quarters it is necessary that the announcement of a definite policy on this one point at least should be reached without any delay. We hope that that will be done.

Railway Electrification.

The interesting paper by Mr. H. Parodi, chief engineer of the Orleans Railway Company, which was read before a joint meeting of the Institution of Electrical Engineers and the British Section of the Société des Ingénieurs Civils of France on Thursday last week, comes at an opportune moment. We have on previous occasions drawn attention to the practical views on electrical engineering which characterise our French *confrères*, and the extraordinarily rapid development of electricity supply in the rural areas which they have brought about within the few years which have elapsed since the end of the war. That development is still in steady progress, and Mr. Parodi's paper is intended to show how the important scheme of electrification which is now being carried out by the Orleans Railway Company fits into the general electrification programme of France. The conditions differ from those obtaining in this country in that in France electricity is generated both by steam and by water power; but the conclusions arrived at by the engineers concerned are largely independent of this consideration, in so far as they arise out of the nature of the load.

As the author remarks, it is a question not merely of substituting electric for steam traction on a line having a dense traffic, but also of providing a large distribution system, of which the power plants and transmission lines can be utilised for a supply of electric power in all the districts through which the railway passes. In France the electrification of the railways is considered as a part of a more comprehensive scheme—not as itself the sole end to be attained, as in most other countries.

The author points out that the general direction of the main transmission lines should practically coincide with that of the railway lines on which there is heavy traffic. As the urban industrial load is far greater than the traction load, this procedure relieves the railways of the excessive burden of capital charges that would result if the transmission lines were erected solely for traction. On the other hand, the long-hour load of the railways enables the shorter-hour industrial load to be handled more economically than would be possible if the latter were alone to be dealt with.

It is interesting to learn that the French Government is considering a programme of gradual equipment and of progressive linking-up of the various distribution systems, rather than Government control of electricity generation. This mode of attaining the desirable end of interconnection—which eventually would take place through the bus-bars of the sub-stations—was commended by Mr. Roger T. Smith in his comments on the paper, in preference to the installation of a grid of high-pressure interconnecting lines, which, he said, offered little prospect of a cheap supply of electricity. Incidentally, it is identical with the procedure which we have advocated in these columns on more than one occasion, as the natural and most economical course to follow in the evolution of a national network.

The paper was read also before the Institution at Birmingham, when Dr. C. C. Garrard and Mr. F. J. Moffett, in the discussion, emphasised the importance of including the electrification of railways in the national scheme, in order to improve the load factor. The same view was expressed by Mr. R. A. Chattock and Mr. R. B. Mitchell at the British Industries Fair on February 17th.

In view of the excellent work that the French electrical engineers have accomplished, to which our columns have borne witness, it would appear that British power supply and railway engineers would find it well worth their while to cross the Straits and see for themselves the materials employed in France; and as the whole question of electricity supply in this country is shortly coming before Parliament, it would be a good thing if members of that body also investigated in person not only the legislation which controls (and *hastens*) development there, but also the enlightened methods of administration that have been adopted and the excellent results that have thus been attained. By that means they would learn more in a week than by any other course in six months.

The Electric Propulsion of Ships.

WE have recently had occasion to mention that the electric propulsion of ships is not regarded in this country as being such a practicable proposition as it is in the United States, although both on steamers and on motor-ships the necessary auxiliary machinery is to a rapidly increasing extent being electrically driven. It must, however, surprise many shipbuilders and marine engineers to learn that there are no fewer than 49 ships, nearly all of which are of American origin, ranging from the largest and fastest warships of 180,000 horse-power each down to harbour tugs, in which this system of propulsion has been successfully employed. The North-East Coast Institution of Engineers and Shipbuilders is, therefore, to be congratulated upon having persuaded Mr. Eskil Berg, of the General Electric Co., of America, to present to its members a paper setting forth the advantages which, it is claimed, are obtained by utilising electricity as the means of propelling a ship in preference to the more usual systems of propulsion employed on British-built vessels.

From the abstract of Mr. Berg's paper, which will be found elsewhere in this issue, it will be gathered that the electric drive has much to recommend it, both as regards initial cost and the subsequent operating and maintenance charges. The General Electric Co., of America, has been responsible for the electrical equipment of a large number of the vessels built in that country, and in a competitive tender for a 22,000-ton liner having machinery of 17,000 h.p., it was found that the price of the complete electrical propelling equipment was substantially the same as that of an ordinary geared-turbine installation; but on account of the simpler and less costly foundations, piping, oiling system, &c., it was cheaper than any other method of propulsion proposed. It is unnecessary to reiterate the other favourable aspects of electric propulsion as applied to a vessel of the liner class, as they are set forth in detail by Mr. Berg, but it may be noted that on other types of ship, such as the cargo carrier which forms the bulk of the merchant tonnage of the world, equally substantial advantages would accrue. This is demonstrated by the fact that electric propulsion has been applied to almost every type of ship afloat, including not only the various kinds of screw-driven ships, but even paddle-wheel and stern-wheel driven vessels. It is almost unthinkable that any American commercial concern would purchase electrically-propelled vessels unless it was convinced that it was getting value for its money, and certainly it would not be expected to book repeat orders as many of them have actually done.

The question will at once arise: why has not electric propulsion been tried to a greater extent in this country? We have it on the authority of a high official at the British Admiralty that electric propulsion was seriously considered for the propulsion of some of our recent warships, but that for certain reasons—not due to inherent defects in the electrical system itself—it was deemed inadvisable to adopt it. In the case of merchant ships, the true reason is, we think, indicated—albeit accidentally—by Mr. Berg when he mentions that the equipment required on board ship, both as regards the engines and the electric generators, is of the type so successfully developed by designers and builders of land plant. This means that the contract for the machinery of an electrically-propelled vessel laid down in a British shipyard would be best supplied by a firm of engineers building ordinary electric power-station machinery, or, alternatively, the shipbuilder would have to face the initial expenditure on the necessary patterns, new equipment, &c., which is inseparable from the production of an entirely new type of machine. The shipbuilding industry has during recent years been passing through a period of deep depression; indeed, it is still the most depressed of the different branches of our great iron and steel trades, and it is certain that few, if any, of our great shipbuilding firms would be prepared to undertake so great an expenditure without the prospect of its being justified by numerous repeat orders. Moreover, the contract for such ships as are being built are eagerly sought after, and the prospect of sub-letting the contract for the machinery to a firm of electrical engineers is met by quoting the lowest possible price for marine machinery of the more conventional form. We feel, however, that with the return of prosperity to the shipyards of these islands—prosperity which is long overdue and which, we hope, will soon materialise—the prospect of a contract for the propelling machinery of a ship being placed with a firm of electrical engineers would be far greater, and the electrically-propelled ship might then have a chance of proving its merits to the British shipowner.

The London Power Co.

THE appearance, at the beginning of the week, of the prospectus of the London Power Company, shows that the West End group of the London Supply Companies are getting under way at last. The £3,000,000 capital they are starting with ought to give them an opportunity to release some of that pent-up energy for reform and reconstruction which, according to abundant evidence given at courts and hearings, has been dammed up for unnumbered years by restrictive legislation. Anyhow, they are free now to proceed with a comprehensive centralisation scheme. We see by the prospectus that the new company embodies a concentrated essence of the directive genius of the ten West End companies, one director from each company constituting the Board. As regards administration, this staff ought certainly to augur success. The engineers are Sir Alexander Kennedy and Mr. G. W. Partridge. Sir Alexander, *inter alia*, has two of the most successful, financially, of the London companies to his name (Westminster and St. James'); and Mr. Partridge brings, also *inter alia*, an obvious aptitude for obtaining contracts for power supply from recalcitrant bodies (as witness his railway supplies) and for successfully carrying them out afterwards. Turning to the general manager, Mr. W. A. Pearman, here also we have a record of success in his work on the financial and administrative side of the Westminster company. It was Mr. Pearman, it will be remembered, who so effectively dealt with the financial side of the West End Companies' scheme before the Commissioners at the London and Home Counties inquiry. Also he played no mean part, we understand, in modelling and finally knocking into shape that all-important sliding scale under which the West End companies will now operate. But he does not often come into the limelight.

We wait with great interest the effect of this unification of control upon the operation of such an important group of companies. The figures as to economies effected will be valuable, as this is the first really comprehensive scheme of the kind. Moreover, this practical example will encourage the others and perhaps dispel the timidity of those still standing on the brink of reform. The company, as we learn whilst going to Press, has lost its Bill, and this may hamper its progress; but there is plenty of scope remaining for its activities. Captained as it is, and cargoed with three millions, this barque ought certainly to sail to success, and we wish it heartily *bon voyage*.

Boiler-Room Practice.

Coal Flow, Air Flow, and Steam Flow.

By JOHN BRUCE.

(*Concluded from page* 285.)

Some time ago the writer made a series of observations on two large modern boiler units, and the relation between coal consumed and steam produced for the two periods is shown graphically in figs. 3 and 4, while the data expressing the conditions of operation are shown in Tables IV and V.

On the assumption that the performance of the unit is expressible by a linear equation, it is seen that the no-load losses are 300 lb. of coal per hour, *i.e.*, 300 lb. of coal per hour would be necessary to maintain the unit at working pressure, but not supplying steam for any commercial load.

TABLE IV.

Total coal consumed	lb.	18,144	26,432	19,484	25,088	20,608	18,144	15,904
Total water evaporated ...	lb.	119,250	166,650	139,375	159,375	137,250	109,700	100,625
Coal consumed per hour ...	lb.	7,260	10,580	7,800	10,030	8,240	7,260	6,370
Water evaporated per hour	lb.	47,700	66,660	55,750	63,750	54,900	43,880	40,250
Calorific value dry coal	B.th.u./lb.	12,720	12,150	12,890	12,040	11,750	11,690	11,800
Calorific va'ue as fired ...	B.th.u./lb.	10,760	10,340	11,000	10,280	10,110	10,045	10,150
Moisture content of coal	Per cent.	15·4	14·9	14·7	14·63	14·0	14·05	13·95
Ash content of coal ...	Per cent.	9·7	14·75	7·75	15·35	16·5	17·0	16·55
Duration of test period	... Hours.	2·5	2·5	2·5	2·5	2·5	2·5	2·5

TABLE V.

Total coal consumed	lb	13,440	14,336	20,608	24,192	16,576	18,144	16,576	18,144
Total water evaporated ...	lb.	86,000	100,000	148,750	166,000	117,000	126,500	113,000	120,360
Coal consumed per hour ...	lb.	5,376	5,734	8,243	9,676	6,630	7,260	6,630	3,024
Water evaporated per hour ...	lb.	34,400	40,000	59,500	66,400	46,800	50,600	45,200	20,060
Calorific value dry coal ..	B.th.u./lb.	11,860	12,670	12,500	12,520	12,260	12,320	12,090	12,040
Calorific value as fired ..	B.th.u./lb	10 130	11,085	10,845	10,480	10,500	10,280	10 200	10,380
Moisture content of coal	Per cent.	14·60	12·41	13·25	14 96	14·38	16·37	15·65	13·83
Ash content of coal ...	Per cent.	5 85	11·75	13·00	12·95	14·00	12 25	13·60	13 20
Duration of test period ...	... Hours.	2 5	2·5	2·5	2·5	2·5	2·5	2·5	6·0

These are not in the nature of tests, in the true meaning of that word, but are the ordinary observations that were made for station log-sheet purposes while the units were in commercial operation.

The measurements involved were made by instrument equipment provided for ordinary operation, and were as follows:—

Coal: Metered by Avery weighing machines.

Water evaporated: Indicated by steam flow meters, and calculated from readings of such indications.

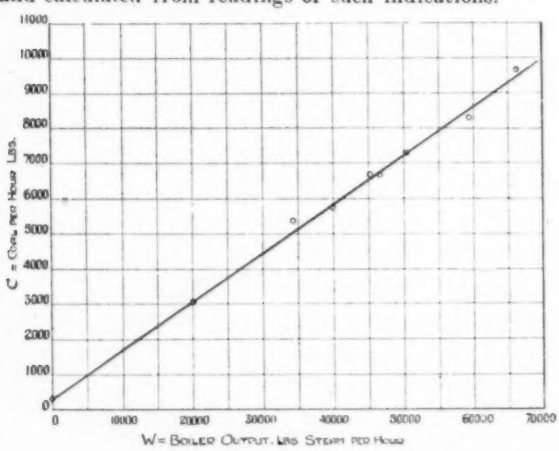

Fig. 3.

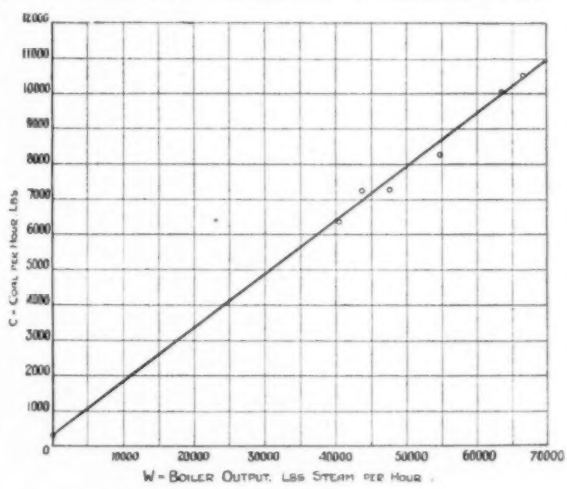

Fig. 4.

Relation between Coal Consumption and Boiler Output.

Temperatures: Measured by thermocouple and resistance pyrometers.

The only addition to the routine of ordinary operation was that the coal was regularly and more frequently sampled for analysis and calorimetric determinations.

From figs. 3 and 4 it will be agreed that the performance of these two boiler units can be reasonably represented by a linear equation, for even at a rating below that of half normal load, the linear relation between coal and water could be maintained (see fig. 3, boiler output 20,060 lb. steam per hour, coal consumption 3,024 lb. per hour).

A considerable number of tests were made to determine this no-load value experimentally, and the figure obtained varied between limits of 280 lb. and 320 lb. per hour. Further, the coals consumed varied over the range usually supplied to the boiler plant, and the effect of any variation is included in the results.

It will be seen from the ash contents of the coals reported in Table IV that there was a considerable variation in the quality of the fuel over the period shown, but the variation did not affect to any great extent the linear relation between coal and water.

From what has now been said, it will be agreed that (1) if the combustion of the fuel is complete; (2) if such combustion can be effected with a constant air/coal ratio, or in other words constant percentage of excess air; (3) if the resistance to the flow of gases through the boiler is constant; (4) if the internal and external heat transmitting surfaces are constantly free from heat retarding coatings; (5) if the combined equipment forming the boiler unit is maintained in a condition of

mechanical perfection; then at all times there exists, within reasonable limits, a definite relation between the factors discussed. These are rate of flow of air for

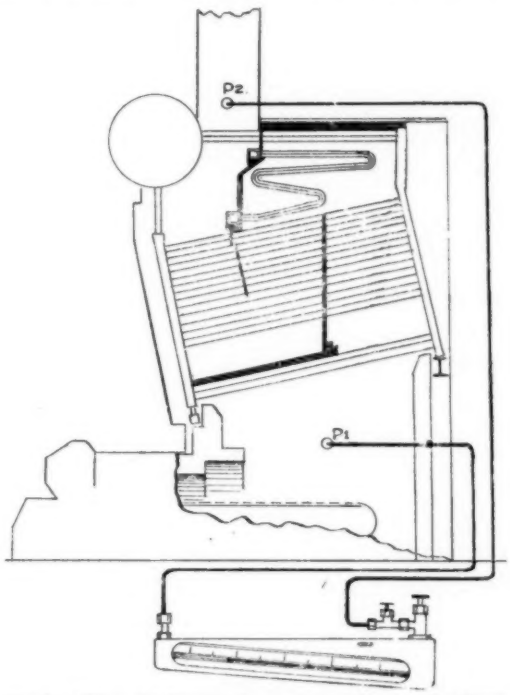

Fig. 5.—Differential Pressure Gauge connected across Gas Passes.

combustion, rate of flow of fuel, rate of flow of gaseous products of complete combustion, pressure drop of gases across gas paths of unit, and rate of flow of steam produced.

Considering the detailed assumptions on which this statement of facts is made,

(1) and (2) are under the control of the operating engineer, and can be attained by correct operation.

(3) Can be attained by the use of soot blowers for the purpose of maintaining the cleanliness of the heat transmitting surfaces in the path of the gaseous products of combustion.

(4) Can be attained by the use of soot blowers and attention to the treatment and production of the water fed to the boiler for the production of steam.

(5) Can be attained by continual attention to maintenance requirements.

It should now be obvious that if an instrument is provided to measure the rate of flow of steam produced and another instrument provided to measure the pressure drop of the gases between two fixed points, a comparison of the two indications considered together will express in certain easily interpreted terms the performance of the boiler unit, and if referred to a predetermined standard, they will further be a measure of the efficiency at any instant at which the boiler plant is being operated.

We will now consider the application of these theories and assumptions to actual operating practice, and for this purpose the case of definite examples will be given.

The writer made a series of tests on different boiler units, the purpose being to determine the relation between boiler output at different loads expressed in terms of steam flow, lb. per hour, and the pressure drop through the gas passes of the boiler.

The units on which the tests were made were of the Babcock & Wilcox C.T.M. type, with Green economisers. B. & W. chain-grate and Underfeed travelling grate stokers. The units were also equipped with Diamond soot blowers.

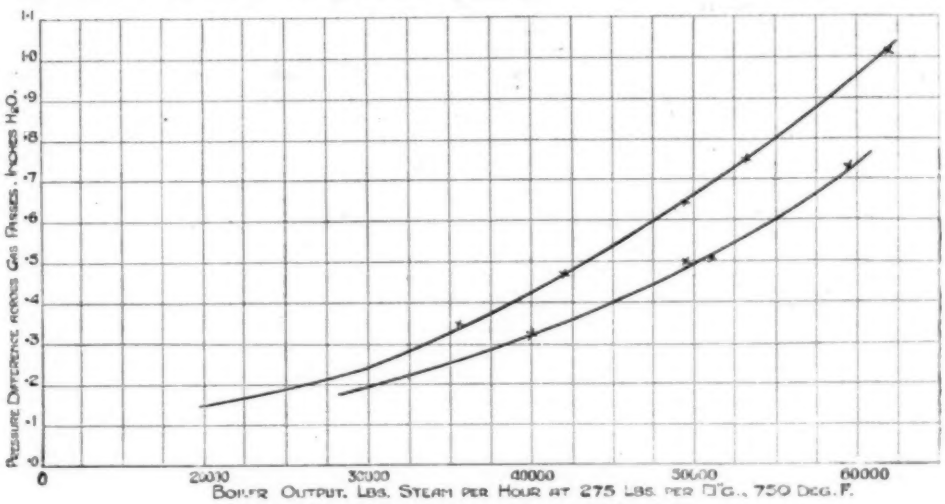

Fig. 6.—Relation between Pressure Drop and Boiler Output.

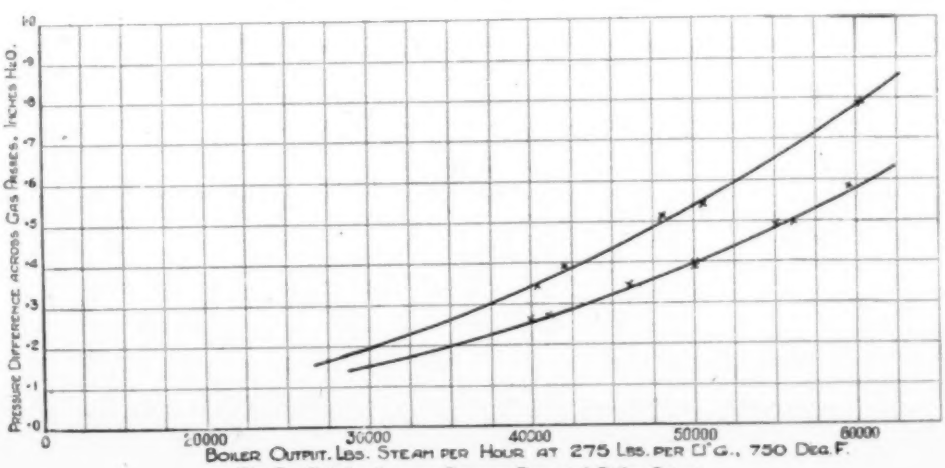

Fig. 7.—Relation between Pressure Drop and Boiler Output.

The instrument equipment of each unit consisted of steam flow meters, Avery automatic coal-weighing machines, a CO_2 indicator, thermocouple and resistance pyrometers, draught gauges, and a Hay inclined leg type differential pressure gauge. The last-named instrument was connected as shown in fig. 5. The foregoing represents the standard instrument equipment of the boilers tested, and in addition to that equipment, an Orsat set was used to check the air conditions and the automatic CO_2 indicator.

The tests were carried out as follows: Conditions were set to maintain a definite output at a constant rate of combustion. The feed temperature and the final condition of the steam being maintained as constant as possible.

The CO_2 content of

the gases, while not having any relation to the *weight* of excess air with which combustion has been effected, nevertheless has a definite relation, for any particular coal, to the *percentage* of excess air with which such coal has been consumed.

The air quantity supplied for combustion was therefore controlled by the CO_2 indications, checked by the Orsat set, and conditions were set to maintain as nearly as possible 12.0 per cent. CO_2.

When conditions throughout the unit were stable, a series of readings, taken at short intervals, was made of CO_2, steam flow, and pressure drop. The test periods were from one to two hours, and at the end of the period the average was taken as being representative of the conditions under which the test was made.

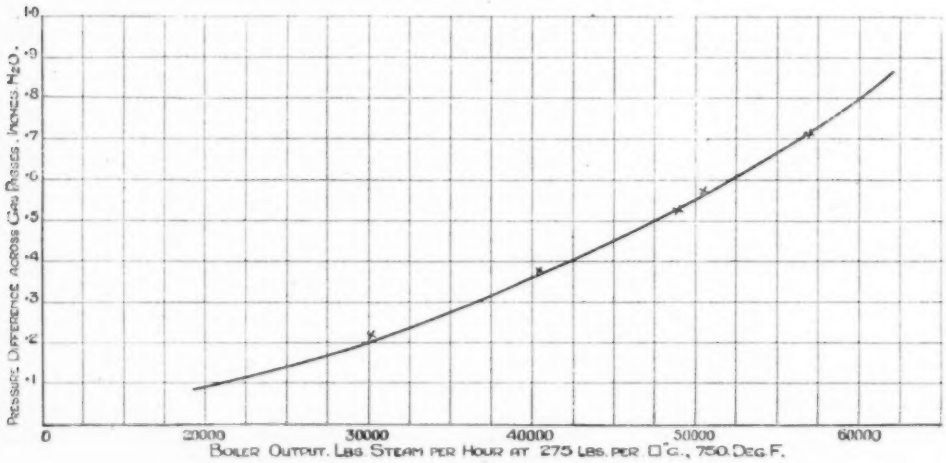

Fig. 8.—Relation between Pressure Drop and Boiler Output.

It was found that with stable combustion conditions the variations in CO_2 and pressure drop were negligible, and though the steam flow meter indications varied, the variations were only of the order of 2,000 to 3,000 lb., and were possibly caused by irregularities in the operation of feed-water regulation.

After the first test run, the pressure drop and the corresponding output of the boiler in lb. of steam per hour were expressed graphically. This point is that on the lower curve of fig. 6, corresponding to 50,000 lb. per hour output and a pressure drop of 0.395 inch of water.

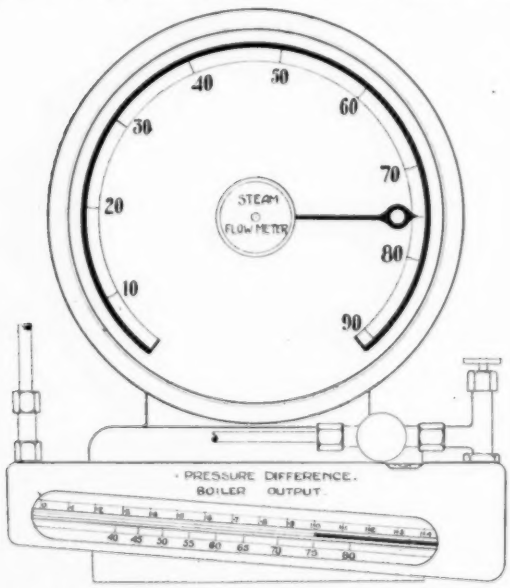

Fig. 9.—Combination of Steam Flow Meter and Differential Pressure Gauge.

From the information thus obtained, the theoretical pressure drops for other outputs were calculated. Plotting these values gave, for this particular boiler and operating conditions, the lower curve of fig. 6.

The output of the boiler was then altered by stabilising another set of combustion conditions, but still maintaining the same coal/air ratio.

It was found that once stable conditions were set, the new actual pressure drop coincided with that particular point of the theoretical curve.

Different outputs covering the commercial range handled by the unit were tried as described, and in every case the pressure drop varied in a definite relation to the output.

The results of the tests are shown in figs. 6, 7 and 8, the actual test results being plotted as crosses against the theoretical curve deduced from the first measured pressure difference.

To further prove the relationship with other air conditions the air quantity was increased to a value corresponding to a reduction to as nearly as possible 11.0 per cent. CO_2.

A series of tests was again made, and the results of these are expressed in the upper curves of figs. 6 and 7.

The application of this operating information necessitates a separate calibration test on each boiler unit. One or more tests are made under the best conditions that can be maintained, the pressure difference corresponding to, say, the commercial range of steam output of the unit are then calculated, and thus a standard of performance is set up which gives the operating staff something definite to "shoot at."

In the case in question, this was done by calibrating an extra scale for the differential gauge in terms of output corresponding to pressure drop, and the gauge and flow meter were then mounted together so that both their indications were observable at once. This assembly is shown in fig. 9.

This arrangement provided what is really one instrument, immediately susceptible to the least change in the operating conditions, the only other items requiring a certain proportion of the operator's attention being the final temperature of the flue gases and the prevention of combustible being carried over by the ash discharged from the grate.

It should, of course, be pointed out that there are reliable instruments on the market which can be installed for the purposes outlined in this article, typical representatives being the Bailey boiler meter, and the combination of steam and air-flow metering instruments produced by Electroflow Meters, Ltd.

Electrical Location of Ore Deposits.—Dealing with some practical points concerning the electrical location of ores, at a meeting of the Swedish Mining Association at Orebro last week, Mr. Sven Lundberg, of Stockholm, is reported to have stated that methods for the electrical discovery of ores have now reached such development that it is possible to localise a conductive ore body, and also ascertain the form of the ore, calculate its depth, and form an idea whether the indications received denote a compact ore or a conductor of a stratified nature. After referring to the discovery of copper ore by electrical means at Bjurfors in Vasterbotten and the Boliden ore in the same district, the author says that the method is very economical. At the same time the work is so complicated that it requires a specially-trained staff. Under these circumstances an organisation has been formed for the development of electrical research under the title of the A. B. Elektrisk Malmletning. The speaker added that it could not be denied that many of the efforts made in Sweden in connection with the electrical surveying of ore had totally failed, the interested parties having materially over-estimated the general applicability and range of the electrical methods.

The "Electrolux" Refrigerator.

An Interesting Development of the Platen-Munters System.

THE above-named refrigerator is unique in that it is a contrivance for continuously producing cold without the aid of any mechanical moving parts. Its simplicity is an indication of its reliability in service, while it is impossible for the user to upset the action.

The appearance of the finished article is shown by fig. 1; as will be evident from fig. 2, the essential

Fig. 1.—The "Electrolux" Refrigerator.

apparatus consists of three cylindrical iron vessels connected by iron pipes, charged with distilled water, ammonia, and an inert gas (such as hydrogen), the whole system of pipes and cylinders being welded together and thus hermetically sealed to prevent the escape of their liquid or gaseous contents.

Means are provided for heating one of the cylinders, electricity being of course the most convenient agent for this purpose, and a small quantity of cold water is allowed to flow over one of the other cylinders and also around one of the connecting pipes, cold being continuously produced in the third cylinder so long as the supplies of heat and cold water are maintained. The liquids and gases are used over and over again and will last indefinitely.

The inventors have ingeniously contrived to entirely overcome the difficulty (due to the pressure difference) which is encountered when an attempt is made to circulate a refrigerant. Taking advantage of Dalton's law, according to which the total pressure in a vessel containing a mixture of gases is the sum of the pressures which would be exerted if each of the gases occupied the same vessel alone, they have introduced an inert gas (hydrogen) into the low-pressure side of the apparatus, the effect of which is to raise the total pressure on the l.p. side so that it equals that on the h.p. side; the pressure is practically uniform in all parts of the apparatus, and consequently circulation is set up by the application of heat to one part of the system.

The evaporator is shown on the left in fig. 2; on the right, outside the cabinet, are the generator and absorber with the rectifier and condenser at the top and the heat exchanger at the bottom. It is advisable to place the evaporator in a tank containing a liquid of low freezing point (salt and water) which will act as a "cold" accumulator and make it unnecessary to maintain the continuous operation of the refrigerator. This cooling tank is so arranged that small trays containing water can be inserted in it for the formation of ice for cooling beverages, &c., for household use.

The process of refrigeration is as follows (see fig. 3): When the mixture of ammonia and water in the generator (1) is heated, the ammonia is driven off into the pipe leading to the evaporator (3); the water vapour is condensed in rectifier (9), which is provided with metal fins, and falls back (due to the inclination of the pipe) into the generator (1). The ammonia gas is further cooled and condensed in the water-jacketed condenser (4) and in falling on to the disks (14) evaporates and mixes with the hydrogen which enters through pipe (12). The mixed gas is now heavier than pure hydrogen, and so falls to the bottom of the evaporator (3), whence it is conducted through pipe (13) into the absorber (2).

The evaporation of the ammonia gas in the evaporator results in a great lowering of its temperature, which, in turn, cools the non-freezing solution around it and the chamber in which it is situated. The lower the pressure of the ammonia gas, the lower will be the temperature. As previously explained, the *total* pressure is the same as in the generator, but by introducing sufficient hydrogen gas to produce the greater part of this total, the ammonia pressure can be only equal to the difference. A reduction of the ammonia pressure with the consequent lowering of temperature is thus obtained.

Returning to the generator, the weak liquid remaining in (1) after the ammonia gas has been driven off flows through pipe (5 and 11) into the water-cooled (10) absorber (2) due to the difference of levels in the two vessels and in falling over the disks (15) it rapidly absorbs the ammonia gas that is with the hydrogen, thus allowing the lighter hydrogen to rise and pass again through pipe (12). The strengthened ammonia liquid flows out at the bottom of (2) and is preheated at (5); it is then boiled in the coil (7) (which surrounds the heating medium (6) and the gas bubbles so formed result in a pumping action sufficient to lift the liquid from the absorber (2) to the higher level (8) of the generator (1).

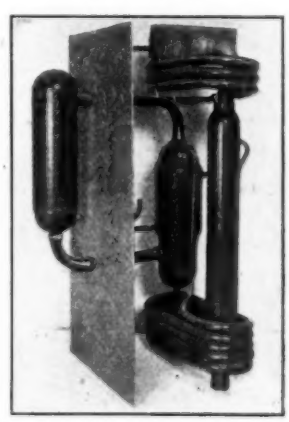

Fig. 2.—The Cooling Unit.

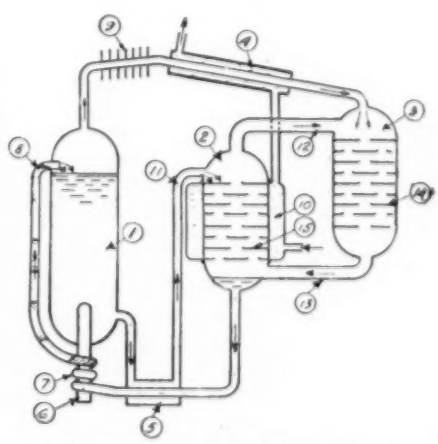

Fig. 3.—Diagram of Circulating System.

The invention is of Swedish origin, but we understand that Messrs. Electrolux, Ltd., intend to manufacture the refrigerator in this country. A demonstration was given at the Savoy Hotel on Tuesday by Dr. Hele Shaw, F.R.S. Major H. A. Wernher, D.S.O., presided. Further reference to the matter will be made next week.

Electrical Freedom—The Contractors' Creed.

By L. L. ROBINSON, M.Inst.C.E.

No supply engineer who enjoys a little innocent humour should be content until he gets a copy of the flame yellow pamphlet published by the Electrical Contractors' Association, entitled "Electrical Freedom."

On the first page the contractors' creed is set forth:—

WE BELIEVE wholeheartedly in the need for ample, cheap, and uniform Public Supplies of Electricity.

WE BELIEVE that such public supplies of electricity should be under Public Control; that such supplies of power should be under State or semi-State Direction or Regulation.

WE DO NOT BELIEVE that Public Control or Public Trading should extend beyond the provision of such ample supplies of the Power itself.

The pamphlet does not say why the electricity supply industry should be under public control, but the supply of installations and fittings under the control of the electrical contractors only.

Surely, if the supply of electricity is to be cheap and abundant, the installations must be cheap and abundant also. All the newer uses of electricity must be catered for as energetically as lighting. The contractors are alive to the fact that the municipalities give the cheapest and most efficient supplies of electricity; is there any sound reason to suppose that they or the companies cannot likewise supply the cheapest and most efficient installations and service to consumers?

On the contrary, certain outstanding examples have shown that the consumer gets the best service where the supply authority takes the responsibility for the complete service to the consumer. In the very successful undertakings of the United States, the supply authorities are laying greater and greater stress upon the necessity for the supply authority to look after all the consumers' needs. The contractors need only read the American technical Press to find this out for themselves.

The humorous side emerges from the examples of other services used by the authors of the pamphlet to show why installations should not be provided by the supply authorities, such as the following:—

"WE BELIEVE, for example, that the provision of adequate water to meet the Public needs should be in the hands of Public Authorities under Public Control.

"WE DO NOT BELIEVE that plumbing work, the sale and installation of domestic pipe lines, boilers, baths, kettles and other water conveying or using apparatus should be undertaken by Public Authorities.

"WE BELIEVE that such Retail Trading should be in the hands of existing plumbers and ironmongers, who already handle such water-conveying and water-using goods."

What an unfortunate example to take! Water supply is an absolute necessity and monopoly. Electricity is not an *absolute* necessity. However desirable its use may be, it is by no means a monopoly, since light, heat, power, &c., can be supplied by other means.

Water is usually supplied at a fixed annual charge based on rateable value. Obviously, the less water used the better for the water supply authority. With electricity the reverse is the case.

When the piping is done by "existing plumbers," the water supply authority's desire for economy in use is usually served by the plumbers' anxiety to use the smallest possible pipes and the cheapest possible fittings.

My own London flat is a beautiful example of this. I live on the third floor. All the hot-water cisterns are served by an inadequate common feed pipe from the cold-water tank in the attic. The cold water goes in at the bottom of the tank and the supply to the bath also goes from the bottom of the tank; it should go from the top, but as the supply pipe is so small, the expedient of taking it from the wrong place was resorted to by the "existing plumber." A second bath-full is not available until some considerable time after the first one has emptied the inadequate hot-water cylinder.

If a resident in a lower flat uses water as fast as he can, he gets my hot water (or rather he did, until I put a non-return valve in), because the feed pipe is too small to supply him adequately from the cold tank.

Yet do not contractors for electrical wiring do much the same thing, namely, put in wires so small to lighting points that when the inevitable iron, kettle, vacuum cleaner, or small radiator comes along they are found wanting, and the installation has to be done again?

No!—the case of water will not do to illustrate the ideal method of dealing with electricity.

Why is the gas industry not taken as an analogous example? Is it not because all, or nearly all, gas supply undertakers have realised that they could not for a year withstand the electrical competition if they did not provide complete service of gas and installation work for their consumers?

The contractors, at last, believe in assisted wiring and hiring. A welcome change—but only if it brings grist to their mill without effort on their part. But do they really want it? I have prepared a schedule of prices which show a good profit on my costs and on which I will willingly give out a very considerable amount of work to registered contractors. Several have had orders on this schedule, but only one or two contractors are glad to have them and ask for more—others won't touch the work unless they get a higher price. The electrical contractors state that installation work is not fitted for public bodies, and that public bodies cannot do this work efficiently. How does this fit in with the fact that there is not a rush for my work at prices which show at least 20 per cent. profit on my costs, and in connection with which the contractors would have no business-getting costs or financial risk?

If I, as a public servant, am inefficient, a price which shows 20 per cent. on my cost must produce a far greater profit on their efficient work, so they ought to be scrambling for my orders!

In my area the united efforts of the retailers did not connect four vacuum cleaners per month to my mains. That did not satisfy me, so I started to sell vacuum cleaners on up-to-date lines. I am thereby connecting about 27 per week, and doubtless the contractors are doing better than they did since I have sold the vacuum cleaning idea to the public.

Of course, they are crying out now about the business I am taking from them. Nonsense! I have made a new business that they dreamt not of. If I had told them a month ago that the district could absorb this quantity of vacuum cleaners they would have laughed at me.

What have the contractors done in other lines than lighting and fittings? In my area this is not an unreasonable statement of their record:—

Vacuum cleaners.—Very little.
Washing machines.—Nil.
Power.—A little—after the undertaking had well sold the idea to the manufacturers.
Coking.—None. Water heating.—None.
Heating.—Some. Domestic refrigerators.—None.
Factory uses other than power.—None.

Who is going to sell my product fast enough to make it ever cheaper and ever more abundant if I do not go in and look after the service and selling myself?

The contractors have not done it in the past. Could I trust the future to them? I fear not, and, therefore, I must continue to sell the means of selling my product myself, lest the business be doomed to stagnation. No supply engineer wants the worry of a sales department. If the contractors had energetically pushed the sale of electricity for all purposes the supply authorities would have been well content to leave the work in their hands.

But sales were slow, and largely restricted to the lines which sold most easily, without systematic canvassing, &c., so the electricity supply engineer, like the gas supply engineer, was forced to take a hand in a business which has been more than adequately justified by the results achieved. After all, the proof of the pudding is in the eating.

The British Industries Fair.—III.

Electrical Features and Meetings.

WEDNESDAY, February 17th, was "Electrical Industry Day" at the Birmingham section of the British Industries Fair. Six associations of the industry were represented as well as 20 supply undertakings, both company owned and municipally owned, and all were potential buyers. Representatives were present from the Incorporated Municipal Electrical Association, the Institution of Electrical Engineers, the Association of Mining Electrical Engineers, the Provincial Electric Supply Committee of the United Kingdom, the Association of Electric Power Companies, members of the Birmingham Electric Supply Committee, and a number of exhibitors and others attended and among whom were the following:—Sir Hugo Hirst, Dr. Railing (G.E.C.), Mr. Barnard (Callender's), Mr. Tippetts (British Electrical Federation, Ltd.), Mr. Lumley (N.P.L.), Dr. Kaye (N.P.L., Mr. Legge (Shropshire Power Co.), Mr. Beauchamp (E.D.A.), Coun. J. Hewitt (St. Helens Corporation), Coun. G. Beaumont (Huddersfield Corporation), and Messrs. Cossens and Coulthurst (South Wales Power Co.). Councillor H. E. Parkes, President of the Birmingham Chamber of Commerce, presided at a luncheon. We reproduce a group photograph taken subsequently (fig. 6).

Fig. 6.—Representatives of the Electrical Industry at Castle Bromwich.

Mr. T. R. MARTIN (of Messrs. J. H. Tucker & Co.), vice-chairman of the Fair Management Committee, pointed out that that was the first official electrical visit in connection with the Fair. For the first time, the display of the electrical industry was of a representative character, something like 80 firms being exhibitors. That Section of the Fair was national and not local in its outlook, and the organisers were hopeful that the exhibitors and others identified with the industry, would become annual participants. The one object of the Fair was to promote British trade, and to attract overseas buyers. Such a Fair held annually in unbroken continuity should be a real asset, for business could be done in a proper atmosphere, and under conditions which enabled manufacturers to show their products to the best advantage. He knew of no other industry that was better served by its Press, and the organisers of the Fair owed to them a particular debt of gratitude for their help. He thought they would do a good service to the industry if they went to Leipzig and told manufacturers all about it. They entertained the hope that they would be able to make the Fair at Birmingham a world market, for at least two weeks in the year.

Fig. 7.—A View of the Electrical Section.

Sir HUGO HIRST, in proposing "The Electrical Industry," observed that that industry was becoming a very powerful factor in our industrial and social life; and the manufacturer could look squarely in the face any manufacturer from any other country. If they were to "deliver the goods" the whole industry must work together as a team. The experience of all engaged in it must be put into the common pool. Manufacturers were doing much and spending large sums of money in the field of research. Every industry would be rejuvenated if electricity was properly introduced into it. He asked those present to welcome the forthcoming Electricity Bill. There might be details in it, with which some would disagree; there might be important points of details which they would like to see altered. Nevertheless, the object of the Government in introducing the Bill was in order that real service might be given to the country, and he believed that the ultimate result would be that electricity would do for this country what steam did for it one hundred years ago.

Mr. R. A. CHATTOCK (President of the Institution of Electrical Engineers), in responding to the toast observed that Sir Hugo Hirst had referred to the value of collaboration between the supply side and the manufacturing side of the electrical industry. That point had not been lost sight of and a joint committee of the two interests was doing useful work in trying to ascertain the views of both sides across the table with regard to the design of electrical machinery, steam generators, &c. He thought that form of collaboration was most valuable to the industry and it was a point for satisfaction that both supply undertakings and manufacturers were represented at the Fair. He put forward an earnest appeal to the supply branch to support the British Electrical and Allied Industries Research Association, because it was out to benefit quite as much as the manufacturing side by the work that was being done. The Institution of Electrical Engineers was anxious to give the Government's electricity measure all the support possible. They wanted a scheme that would not only cheapen the cost of supplies in the country but would extend the use of electricity. He thought they could whole-heartedly support the Government in that ideal. The method that were proposed must be open to criticism but as they had not yet had an opportunity of seeing the Bill they did not know what the financial proposals were. He thought that they ought to be glad that the Government was not going to subsidise the in-

dustry, because subsidies meant control of some kind and they in the electrical industry did not want to be unnecessarily controlled. They were carrying on very well now and he thought they could develop in the future on the lines the Government wished, without control. He considered that railway supply should be included in the scheme.

Mr. R. B. MITCHELL (President of the Incorporated Municipal Electrical Association) also replied, and endorsed what Mr. Chattock had said with reference to the joint work of the committee representing supply undertakings and manufacturers. Regarding the condition of the industry and the satisfactory export position, he expressed the hope that before long an equally good report would be forthcoming so far as the home trade was concerned. On the supply side he thought it was correct to say that fair progress was being made in nearly every undertaking. In Edinburgh they had doubled their output during the past few years and very good headway had also been made in Birmingham and Manchester. In Glasgow the lighting load showed a substantial increase. He agreed that railway electrification was a necessary adjunct to the scheme as a whole and he was hopeful that the railway companies would come into line.

Fig. 8.—The Corporation's Mercury-vapour Rectifier Substation.

Fig. 9.—A View of the Birmingham Electricity Supply Department's Stand.

Reverting to the exhibits, we continue below our description of some of the stands and reproduce (on p. 329) a view of a section of the electrical display (fig. 7).

The Birmingham Electric Supply Dept.

As previously reported, one of the principal exhibits of this Department is a mercury arc rectifier sub-station of 184-kW capacity, as used in outlying areas to convert 5,000-V, 25-cycle, three-phase alternating current to direct current at pressures of 220 V and 440 V for distribution to consumers for lighting, power, heating and cooking purposes. This is illustrated in fig. 8. A sub-station as installed by the department on larger consumer's premises is also shown, including high- and low-pressure switchgear, and a 100-kW transformer to reduce the pressure from 5,000-V, 25-cycle, three-phase a.c. to 440 V, 25-cycle, three-phase for power, and 110-V, 25-cycle, single-phase for lighting purposes. Another exhibit is an electrically-driven boiler scaling outfit complete with a small motor, and mounted on a trolley to enable it to be moved from point to point; also a similar machine especially suitable for scaling condenser tubes. A double spindle pedestal-type polishing machine is on view, the polishing mops being carried on the shaft of the 1½-h.p. motor supplying the power. There is also a plating outfit, the power being furnished by a 5-h.p. motor generator set. Among the electric tools shown are a bench drill of ½-in. capacity, with a motor suitable for working on either d.c. or a.c.; and a chipper suitable for breaking concrete, steel chipping, riveting, &c., operated by a 1-h.p., 220-V, d.c. motor. A static condenser is shown controlling the power factor of a squirrel-cage motor, thus demonstrating the apparatus required to improve the power factor on large consumers' installations, thereby entitling them to the special discounts allowed by the Department. The effect of switching on the condenser is shown by the operation of a special power factor meter. Four automatic electric furnaces are shown by

Fig. 10.—The G.E.C. Stand at Birmingham.

AUTOMATIC ELECTRIC FURNACES, LTD., suitable for working on 220 V d.c., and fitted with automatic temperature control as follows: (1) Internally-heated resistance furnace for annealing iron, copper, brass, nickel, aluminium, silver, &c., also for enamelling and carburising (load 23 kW); (2) a 3-kW oven suitable for tempering tools, &c.; (3) a 3-kW automatic tool-hardening furnace complete with magnetically-operated device for indicating the exact point when an operation is finished; and (4) a 9-kW furnace for hardening high-speed steel, &c. A 6-kW, 220-V, coffee boiler, capable of dealing with large supplies at café rush hours, is exhibited. A small electric coal-cutting machine is also shown, and in addition, there is a representative supply of lighting fittings, various types of electric fires and heating apparatus, fans, irons, cookers, and modern labour-saving appliances. A view of the stand appears in fig. 9.

General Electric Co., Ltd.

This company's exhibit was dealt with in our last issue. This week we reproduce a photograph of the stand (fig. 10) which was received too late for insertion with the description. The stand occupies practically the whole of one wall of the building "C," in which the bulk of the electrical exhibits are housed.

George Ellison.

A great deal of heavy switchgear is shown on this stand, apart from a working exhibit on an adjacent stand from which a mercury-arc rectifier sub-station provides power for the building. A prominent exhibit is a two-panel unit-type draw-out l.p. switchboard, comprising a 250-A and an 800-A circuit breakers with the usual no-volt and overload releases, adjustable time-limit attachments and tank lowering gear. Mechanical interlocking arrangements ensure that the breaker is open before it can be withdrawn or replaced. The units are mounted on tubular stands and are bolted together to form a continuous switchboard. A h.p. panel is also shown; this is illustrated in fig. 11. It is an oil-immersed free-handle draw-out equipment rated at 200 A and 3,300 V. It consists of a main circuit breaker fitted with no-volt and direct-acting overload time-limit release coils, fully interlocked tank-lowering gear, and instruments all mounted on tubular stands. Another apparatus on view is a three-way l.p. lighting board specially suitable for collieries and other exposed positions. It comprises three 40-A oil-immersed free-handle d.p. circuit breakers, each provided with two overload release coils and various forms of cable boxes. Other exhibits are a 150-A l.p. flameproof oil circuit breaker; a 100-A l.p. air-break, triple-pole, explosion-proof, gate-end breaker with free handle, three overload time-limit release coils, cable box and reversing plug, the whole mounted on skids; a l.p. air-break, air-cooled stator and rotor control panel, consisting of a mill-type free-handle breaker provided with the usual automatic features, mechanically interlocked with a non-automatic air-cooled rotor starter; a l.p. oil-immersed and cooled stator and rotor control panel; a l.p. oil-immersed auto-transformer starting panel with a change-over switch and correct-sequence device; a l.p. 20-A, totally-enclosed, oil-immersed, star-delta starter; a l.p. drum-type reversing controller; a d.c. drum-type reversing controller with

patent magnetic blow-out system and roller contacts; a resistance frame; junction boxes, &c. A patent double-valve time lag device is shown for the first time. This is designed to provide a sufficiently long delay under the overload due to the starting current taken by a squirrel-cage motor while giving the desired delay with normal overloads. There is a hollow piston which houses a valve mounted on the same stem, a spring being provided between the piston and valve to keep them apart normally. With currents up to about twice normal in the overload coil this spring holds the piston and valve apart, leaving the clearance between them in addition to the ordinary clearance between the piston and the cylinder for the

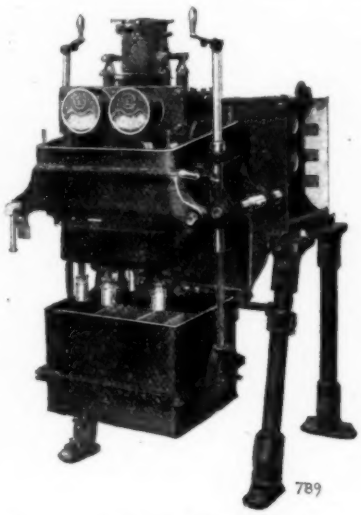

Fig. 11.—An Ellison 3,300-V Draw-out Unit.

passage of the oil, thus reducing the retardation. With currents exceeding about twice normal the pull on the overhead core is sufficient to compress the spring, bringing the valve on to its seating in the piston and leaving only the clearance between the piston and the cylinder for the passage of the oil. This clearance can be adjusted in the ordinary way by screwing the cylinder up or down relatively to the piston, the retardation being so lengthened or shortened.

A section of the stand is devoted to a display of a new synthetic resin impregnated paper insulation. This is used by the firm in its switchgear and is available for other firms who require it. In appearance it is chocolate coloured and has a very fine surface. It is easily machined, although it is too hard to stamp. Excellent dielectric properties are claimed for it.

The Siluminite Insulator Co., Ltd.

Prominent on this firm's stand is the dog safely seated on a live rail, which is a feature of most of its advertisements. A variety of switchboard panels ranging from sizes suitable for power work down to small panels for radio sets, are exhibited. Several of these are in special colours, as white and blue enamel. Samples are shown of the new "Grade 2" insulating material which has recently been placed upon the market. This is able to withstand a certain amount of arcing without carbonising, and on this account is very suitable for switch bases with divided fillets moulded in one piece, and for the insulation of core plates. The company is showing a further new material which is at present under test. This is known as "Arcovite Grade 2." The growing use of overhead power lines in this country gives added interest to a special type of bird guard which the company exhibits. This guard will not cause a short circuit in the event of birds coming in contact with the overhead lines. It is mechanically strong and easily fixed. The remainder of the exhibit is composed of track insulators of various designs as supplied to leading railways, sections of insulating material in different grades for overhead line insulators, arc shields, finger shields, and tubes and rods of the company's various materials.

Siemens & English Electric Lamp Co., Ltd.

The lighting on this stand is carried out with Siemens gas-filled lamps in "Silvaray" fittings, which are suitable for shop window illumination. Apart from this "working" exhibit, the company shows a selection of "Siemens-Xcel" domestic electrical appliances; the cooker (fig. 12) is a new design. It is a standard upright type of cooker with a hob mounted on the top of the oven. Under the hob is ample space for warming plates and grilling. The hob has two special type boiling plates and a 3-heat grill with a removable damper. The oven measures 15 in. x 16 in. x 16 in., and is equipped with elements of 2,100 W; the total loading of the appliance is 6,900 W. The boiling plate consists of a special circular fireclay plate, 7 in. in diameter, in which are deep grooves which house the nickel chrome spirals. The plate is well perforated to allow escaping liquid to pass through it, and is held in place by a novel cast-iron support provided with three plug-in terminals which engage with sockets mounted on the side of the cooker. A white enamel crown plate slides under the hob to collect anything that is spilt. The entire boiling plate can be instantly removed and replaced. There are also shown various types of irons; electric fires, including bowl fires, well fires, and the standard up-

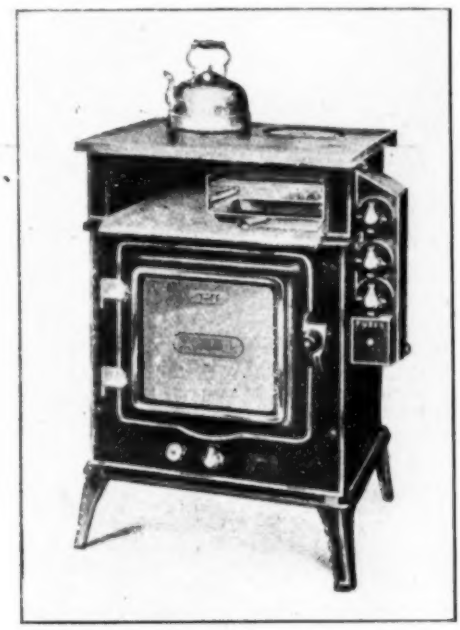

Fig. 12.—The "Siemens-Xcel" Cooker.

right types; electric table cookers; and boiling plates and kettles. The exhibit is rounded off with a display of Siemens "Zed" fuse materials.

Premier Electric Heaters, Ltd.

This company has, as usual, a very attractive display of domestic electrical appliances, all of which are notable for their high degree of finish. Electric fires are one of the chief items, and this year's display includes a range of new designs. These, as will be noted from the example illustrated in fig. 13, have the elements mounted horizontally at the foot of a highly-polished reflector back, which is extended underneath the fire-bars to the front of the appliance. A new form of fire-bar is employed. This consists of a strongly-made fireclay former of double radius, which gives a fairly wide distribution. A large number of kettles are shown, in

Fig 13.—A New "Premier" Fire.

polished and nickel-plated copper; these are fitted with the fusible-plug safety device which we described in connection with last year's Fair. This device is also fitted to some electrically-heated glue pots which are exhibited. For the rest, the exhibit consists of "Smoothwell" irons, hot-plates, urns, saucepans, and many other household appliances.

The National Gas Engine Co., Ltd.

The main feature of this display is a newly designed 66-b.h.p. crude-oil engine, self starting from cold, complete with compressed air starter consisting of an independent engine compressor and receiver. It is suitable for working with the cheapest fuel oil and with minimum compression and low average pressures. A 7-kW generating plant is shown arranged as an automatic engine-driven sub-station for use in connection with d.c. distribution systems where h.p. alternating current is not available. This plant is entirely automatic in its working, and should prove of value to central station engineers. The plant consists of an engine driving a compound-wound generator together with a starting motor and battery. The switchgear is automatic, the controlling feature being a current relay and feeder circuit. When the current in the feeder reaches a pre-determined amount, this relay contacts and the sub-station generating plant is automatically started up, and as soon as its voltage exceeds that of the feeder they are paralleled and the sub-station takes the local load, any excess current being fed back to the main generating station. The plant is shut down again when the local load is reduced to a pre-determined minimum. A 3-kW generating plant with automatic switchgear, is also shown. The electrical portion of the equipment has been made by the Austin Lighting Co., Ltd.

Young, Osmond & Young, Ltd.

This firm's stand is devoted to the display of the "Lightfoot" tubular electric heating system. This is a low-wattage method of heating in which tubes are loaded to 40, 50 or 60 W per foot run, giving temperatures of 160, 180 and 205 degrees F. respectively. The tubing can be fixed round the skirting boards of rooms or corridors, and also made up into appliances. Among the latter are towel rails, garage and car heaters and electric window heaters, examples of which are exhibited on the stand. This is an economical and safe system of heating, and the elements are guaranteed for 5 years.

A. W. Beuttell & Co., Ltd.

Examples of the "Linolite" reflector are shown by this firm, made up for various applications, including shop window lighting, picture lighting, portable showcase lighting, &c. The "A.A." clip is another exhibit. This is an adjustable earthing clip which can be used for pipes varying in diameter from ½ in. to 1¼ in. The same clip can also be used over a rubber band to form a joint between water pipes.

K. F. M. Engineering Co., Ltd.

This exhibit consists of examples of "Internalite" electric signs. These are of distinctive design. Hidden in a small framework are standard type tubular electric lamps, from which light enters the edge of the glass plate affixed to the tube, and is invisibly transmitted between the polished surfaces of the glass by internal refraction. This only becomes apparent when it is reflected by the lettering or design upon the glass which it illuminates, producing a striking result.

Electric Fires, Ltd.

A very representative collection of heating apparatus is shown by this company. One of the principal features is a number of "Electricoal" fires in various designs and finishes. These fires consist of an art-metal grate packed with a realistic imitation of glowing coals. At the back is a polished metal reflector, and heating elements are fitted at the front. The elements are composed of 1-kW plug-in bars, which consist of formers of a dark-red refractory material wound with nickel-chromium wire in a continuous coil. A large number of different patterns of immersion heaters are shown with loadings ranging from 50 W to 12 kW. The latter size is employed for warming Diesel-engine oil to reduce its viscosity. Some of these immersion heaters are made up as self-contained units complete with a snap-switch and plug and socket. Low-temperature heating is represented by examples of finned cast-iron radiators, suitable for installation in garages or other places where radiant heat is not desirable. Other exhibits are bowl fires, treble-purpose cooker-radiators, sample elements, &c.

J. H. Tucker & Co., Ltd.

This company, which is a regular participant in the Fair, has a comprehensive display of its electrical accessories. Among the heavier equipment shown are cast-iron cased combined switches and fuses, knife switches and distribution boards. All types and finishes of tumbler switches are on view, as well as plugs and sockets of distinctive design. The latest products are a new range of tumbler switches of the quick-make-and-break pattern, and grid boxes for sinking switches into a wall. The former include a number which have withstood severe tests at Faraday House and have only broken down when their normal current and voltage ratings have been doubled or trebled. A 5-A switch of this type is shown controlling a fire taking 15 A. The switch box has a grid to which the front plate is secured by four adjustable pins. It is thus possible to make the plate come flush with the wall with little trouble. Other exhibits are examples of multi-way switching, "Kwikwire" plug-in terminals, lampholders, &c.

The London Fair.

Illuminated Signs.

An interesting collection of exhibits of devices for advertising purposes has been brought together in the "General" section, near the Wood Lane Entrance. The one feature common to all of these is motion; in other respects they are "of infinite variety." Amongst those employing electricity are the ATTRACTA ELECTRICAL CO., showing various mechanical, thermal, and gravitational devices, flashers, &c., many of which are operated solely by the heat from a small lamp; Messrs. MARATHON, LTD., showing the "Runsyne" machines; the AUTOCHROME SIGNS, LTD., showing a large variety of signs; Mr. T. J. GABB, and the BRILLIANT SIGN CO (1907) LTD.

Engalithic Mfg. Co. (1925), Ltd.

This company shows "Engalith," a non-inflammable composition of the casein type, which is made in sheets and rods of any colour, and is suitable for electrical insulation as a substitute for ivory, ebonite, &c.

Shades and Fittings.

Several stands are devoted to exhibits of shades for electric lamps, mainly of the silk-on-wire type. Messrs. S. L. MILLER AND CO. have a very attractive range of shades to meet all tastes, and specialise in hand-painted designs; Messrs C. O. GORING show vellum lamp shades, bound with leather thongs, cemented, or stitched; Messrs. HENRY HARVEY & CO., LTD., show mother-of-pearl articles, including shells for use as reflectors; Messrs. WAITE & SON have a great variety of silk and linen shades. Messrs. F. PARKS, LTD., besides silk shades, show charming hand-painted flaky vellum shades, laced with leather, as well as colour-washed and perforated vellum shades, and their new "crackle" designs on jap silk.

Metal and glass fittings of handsome design are on the stand of the PEARSON PAGE CO., LTD.

Ever Ready Co. (Gt. Britain), Ltd.

A large stand is occupied by this company with stacks of its well-known dry cells and batteries of every description. A notable feature is a high-pressure wireless battery in a metal container; this is put up in the most popular sizes, up to 126 volts, and is considered proof against rough usage.

Marconi's Wireless Telegraph Co., Ltd., and the Marconiphone Co., Ltd.

These companies have two stands showing their numerous designs of wireless transmitting and receiving apparatus to advantage, as will be gathered from the accompanying illustration, fig. 14. A prominent feature of the exhibit is the "Straight-8" set, which has been designed to combine the maximum range and selectivity with pure reproduction and

Fig. 14.—The Marconi Stand at the White City.

ease of manipulation. It comprises eight valves—five h.f. and two l.f. amplifiers and a detector. No reaction is used. It is claimed that with this set within one mile of the London station Bournemouth can be received without interference. At night all the Continental stations can be received, and usually the American stations also.

British Electrical Sales Organisation.

We called at this stand just after the King had visited it. His Majesty having used the company's "Rolla" portable wireless set to hear the opening of the Fair by the Prince of Wales. This model, which includes a small loud speaker, weighs 20 lb., and measures 15 by 11 by 7 inches; it has a range of 25 miles, or, with 'phones, 75 miles, and is entirely self-contained. A larger set is made with a mahogany cabinet. Another exhibit is the "Beco" de luxe loud speaker, which is of very neat design, without a horn. Many other patterns are shown on this stand.

Business Notes.

Commercial and Industrial Developments, Business Changes, Trade Opportunities, New Publicity Literature, Liquidations and Failures.

"Do Not Annoy the Editor."—We are indebted to a writer in the current issue of the *Newspaper World* (the column of notes on "Technical, Trade and Class Journals" for the following:—

"This heading was prompted by the remarks of the editor of a certain well-known weekly journal as he slammed the telephone ear-piece on to its hook. 'That confounded contributor,' he said, 'worries me by 'phone, letter, reply-paid telegram, and in person. He sends me a 500-word article by post, follows it up in person to know if it suits, 'phones me as to proofs, and generally makes himself a nuisance. He's a capable man, but I'm dropping him.' Do not be over-anxious to please, ye free-lances!"

The E.C.A. Conference at Brighton.—We are informed that preliminary arrangements for the first annual conference of the E.C.A. and Allied Associations, to be held at the Royal Pavilion, Brighton, on Thursday and Friday, June 24th and 25th, are well in hand, and that there are indications that the event will prove an outstanding success. The present outline arrangements are as follows:—The conference will open on Thursday morning with an address of welcome by the Mayor of Brighton, followed by the E.C.A. presidential address. Later the E.C.A. annual general meeting will be held. On Thursday afternoon there will be papers and discussions on matters of immediate interest to the supply, wiring and sales sections of the industry. During the evening there will be a smoking concert in the music room. On Friday morning papers and discussions will be heard on "Apprentice Training," "Registration," and other matters of vital trade interest. At the close of the business session there will be a short address by the new president for the year 1926-1927. In the afternoon there will be a garden party in the Royal Pavilion grounds, followed, in the evening, by a ball in the Royal Pavilion rooms. A final and detailed programme will be circulated shortly, together with particulars of railway and hotel arrangements.

Unemployment.—On February 8th, the total number of unemployed registered at the Employment Exchanges was 1,164,900, representing a decrease of 10,078 during the week and one of 78,060 during the preceding 12 months.

Municipal Retail Trading.—The Doncaster Corporation is to promote a Bill in which application is to be made for powers to enable that Corporation to sell electrical apparatus. This has aroused keen opposition locally, and the Electrical Contractors' Association has issued a statement in the course of which it is stated: "It is grossly unfair that public funds should be used to set up retail trading competition against existing private traders and that capital raised on the security of the rates should be used in direct competition with rate-paying traders. British electrical engineers and contractors are skilful, competent and enterprising men fully capable of dealing with all the electrical wiring and electrical sales needs of the nation. These men have established businesses all over the United Kingdom, and it is grossly unfair that their pioneer efforts for the past thirty years on behalf of British electrical development should be brought to utter ruin as a consequence of municipal rate-aided trading."

Ship Lighting.—We are informed that the recently-launched R.M.S.P. *Asturias*, which is the largest motor ship yet built, is illuminated throughout with "Siemens" electric lamps.

Orders for British Plant.—Among the orders recently received by members of the British Engineers' Association are the following:—The Royal Mail liner *Asturias*, the largest and most powerful motor liner in the world, has been equipped by the Marconi International Marine Communication Co., Ltd., with one of the most complete wireless installations carried by any ship afloat. This installation will enable the ship to keep in constant communication with land stations and other vessels throughout every voyage. In addition two of the lifeboats carry Marconi apparatus. In connection with the electrification scheme of the Bombay, Baroda and Central Indian Railway, Messrs. Petters, Ltd., have received orders for their direct-coupled electrical generating plants, comprising Petter "S" type oil engines and generators of Laurence Scott & Co.'s manufacture. This firm reports also successful developments in connection with its business in electric lighting plants and oil engines in Venezuela. There has been a considerable expansion in mechanical coal mining in Czecho-Slovakia in recent years. Competition between makers to supply coal-cutting machinery has been keen. British, German and American coal-cutters are in use, yet 40 per cent. of all the machines at work were manufactured by one British firm, Messrs. Mavor & Coulson, Ltd. This firm has also manufactured and supplied 66 per cent. of the coal-cutters at present in use in Belgium, where six other makers are represented. An important contract has been placed with Messrs. Ruston & Hornsby, Ltd., by the Ashford Urban District Council for the supply of three vertical cold-starting oil engines of 600 b.h.p. each. These are required for the new electricity scheme which has been sanctioned by the Electricity Commissioners.

A Manufacturer on National Electricity Supply.—Mr. George S. Francis, of the British Electrical and Allied Manufacturers' Association, addressed a meeting of the Birmingham and District Council of the National Industrial Alliance on February 17th, on "The National Development of our Power Resources." He said that, courageously planned and greatly conceived, electrical energy could provide us with a power more abundant and cheaper than any other. Electrically we were a backward nation, but we possessed the essential resources for leadership if we could evoke the will to employ them. We had lagged in developing electric power for industrial purposes, and supply for domestic purposes was still under-explored and under-developed. The primary condition of realising the vision of the electrical engineer was a broadly-conceived and nationally concerted plan, backed by a well-informed public opinion. The first step towards its realisation was legislative standardisation of frequencies and voltages.

Canton Harbour Improvements.—The *Chinese Economic Bulletin* reports that a scheme for the improvement of the Whampoa harbour, Canton, which has been under consideration for a considerable time, is to be proceeded with. It provides for the erection of quays and warehouses; the building of a light railway 2¼ miles long; the purchase of dredging apparatus; and the construction of an electric light and power plant. It is stated that the last item appears in the second part of the scheme, which is to be carried out when funds are available.

The Philadelphia Exhibition.—The Sesquicentennial International Exposition which is to be held at Philadelphia, U.S.A., from June to December this year, is to include a British section with an area of 45,000 sq. ft., and a net exhibiting space of 26,000 sq. ft. A pamphlet which we have received from the secretary of the British Section, 21, Buckingham Street, W.C.2, contains particulars of arrangements and charges, and includes a form of application for space.

Registered Contractors: The Latest Additions.—The following is a list of applications accepted by the Executive Committee of the National Register of Electrical Installation Contractors on February 12th. At the same meeting five applications were declined and two were withdrawn:—

Harrison, Norman & Co., Preston.
Palfree, C. E., Southport.
Westoe Electrical Co., South Shields.
Gordon, Alexander, Houghton-le-Spring.
Schofield, J. L., St. Annes-on-Sea.
Brantingham Bros., Sunderland.
Watson, William, & Co., Sunderland.
Lankester & Son, Ltd., Southampton.
Marler & Co., Ltd., Newport, Mon.
Dixon, S., & Son, Ltd., Leeds.
Hall, John F., Burton-on-Trent.
Wilson, Albert V., Oadby, Leicester.
White, Alfred, Sunderland.
Jones, F. J., & Sons, Ltd., Chester.
Russell, Joseph W., Watford.
Thompson, John, Hetton-le-Hole.
Wilkinson, Bentley & Co., Ltd., Sheffield.
Henderson & Lawson, Paddington, W.2.
Cooke, George, & Co., Wilmslow, near Manchester.
Assersohn, D., London, E.C.4.
Gilkins, A. V., & Co., Ltd., London, S.W.1.
Higgs & Hill, Ltd., London, S.W.8.
Lee, Beesley & Co., Coventry.
Gompertz, G., South Shields.
Bennett, V. H., & Co., Weymouth.
Davies, G., & Co., Llandrindod Wells.
Malcolm & Allan, Ltd., London, W.C.2.
Jacobs & Drane, Ltd., Cheltenham.

Social Events.—The members of Messrs. LUNDBERG'S Social and Athletic Club held a very successful dance at the Islington Public Library on February 11th. All departments were well represented, nearly 200 members and friends being present, including Mr. G. C. Lundberg.

The second annual dinner of the staff of the St. Helens Corporation electricity undertaking was held on February 11th. Mr. F. N. Rendell Baker, borough electrical engineer, presided, and the guests included the Mayor and the chairman of the Electricity Committee. Mr. Rendell Baker referred to the splendid team spirit of the staff, which was an important factor in low production costs. Reference was also made to the development of the undertaking during the past few years. A musical entertainment was provided by Messrs. Lowe, Cockeram, Dingsdale, Garside, and others.

The annual dinner of the telegraph staff of the Great Western Railway was held at the Hotel Cecil on February 13th, and members of the staff attended from all over the system. Mr. E. J. Collier presided and was supported by Mr. E. C. Simpkins, general assistant to the superintendent of the line, Mr. A. D. Aikman, assistant to the chief accountant, and Mr. F. C. Warren, of the chief engineer's department. The toast was proposed by the chairman and that of the Great Western Company by Mr. G. T. Milford, and responded to by Mr. E. C. Simpkins; "The Visitors," by Mr. H. Weaver, and responded to by Mr. Aikman and Mr. Warren. The toast of the chairman was proposed by Mr. Clarke (Birmingham). A musical programme was provided, mainly by members of the telegraph staff.

Revision of Brazilian Duties.—The *Board of Trade Journal* dated February 18th, contains a schedule of revised "consumption duties" embodied in the Brazilian Budget Law for 1926. These duties are to be imposed on many classes of goods formerly exempt, including electrical appliances. The following items are embodied in the list:—Electric lamps, batteries and apparatus; electricity; fans of any kind; and fires and stoves using wood, coke, gas or electricity as fuel.

Trade Announcements.—THE ANGLO ELECTRIC CO., LTD., announces that "in order to express more accurately the present operations" of the company, it has decided to change its name and will henceforth be known as: Armorduct Cable Co., Ltd. (and reduced).

MR. W. C. PINCOTT has resigned his post as chief engineer of the Criterion Restaurant, Piccadilly, and has commenced business in partnership with Mr. A. Taroni, at 23, Denmark Street, Charing Cross Road, W.C.2, as electrical contractors. He wishes to receive catalogues and lists.

MR. J. H. STEPHENS, the receiver and manager of H. W. Smith & Co. (1920), Ltd., electrical wire and cable manufacturers, Lydbrook, Glos., states that he has disposed of the undertaking and business to Lydbrook Cables, Ltd. The business will be continued on the same lines at that address.

MR. GOUNDRY, electrical contractor, of Reigate, has removed his business to larger premises at 34, High Street.

MESSRS. JOHN SPENCER, LTD. (Wednesbury), have opened London offices at 176-178, Upper Thames Street, E.C.4, under the management of Mr. P. Spencer. The offices will deal with inquiries and orders for all classes of pipework.

Catalogues and Lists.—MESSRS. STEWART THOMSON AND PATRICK, LTD., 10 and 12, Hart Street, London Road, Liverpool.—A stock list of d.c. and a.c. motors, small lighting sets, starters, &c.

MESSRS. RANSOMES & RAPIER, LTD., 32, Victoria Street, S.W.1.—An illustrated catalogue describing the company's petrol-electric mobile crane.

MESSRS. W. J. FURSE & CO., LTD., Traffic Street, Nottingham.—A series of illustrated pamphlets describing the firm's services to the kinema and theatre industry. They include particulars of lighting dimmers, curtain controls, &c.

MESSRS. YOUNG, OSMOND & YOUNG, LTD., Stafford House, Norfolk Street, Strand, W.C.2.—Two illustrated booklets dealing with the "Lightfoot" tubular heating system and its applications.

MESSRS. BRUCE PEEBLES & CO., LTD., Edinburgh.—Pamphlet No. 16D, illustrating and describing "Peebles" polyphase induction motors of medium size (0.75 to 470 h.p.).

The G.W.M. ELECTRICAL CO., LTD., 43, Grafton Street, Tottenham Court Road, W.1.—An illustrated pamphlet advertising battery-charging sets for use upon a.c. and d.c. circuits. Priced.

NEWALLS INSULATION CO., LTD., 4, Mosley Street, Newcastle-on-Tyne.—Pamphlets advertising the company's magnesia insulation for steam pipes, refrigerator installations, &c.

MESSRS. BAXTER & CAUNTER, LTD., 219, Tottenham Court Road, W.1.—A list containing particulars and prices of a.c. motors and starters.

MESSRS. MARELLI & CO., LTD., 19 and 20, Garlick Hill, Queen Victoria Street, E.C.4.—List No. L/126, illustrating and describing the company's fractional h.p. motors.

MESSRS. J. HOPKINSON & CO., LTD., Britannia Works, Huddersfield.—A folder illustrating a large group of high-pressure steam valves which the company has recently supplied to a leading American power station.

ENGINEERING & LIGHTING EQUIPMENT CO., LTD., Sphere Works, St. Albans, Herts.—Three illustrated folders dealing respectively with "Lunax" lighting units, "S.L.R." standard industrial reflectors, and "Interzone" shop-window reflectors.

MESSRS. S. G. LEACH & CO., LTD., 26-30, Artillery Lane, E.C.—A blotter advertising the "Adnil" press button switch; and List L.A. 2/26, an abridged price list of electrical supplies.

THE BRITISH RESISTOR CO., LTD., 32, Clare Road, Halifax.—A booklet dealing with the "Globar" heating element and its applications.

POPE'S ELECTRIC LAMP CO., LTD., 5, Arthur Street, New Oxford Street, W.C.2.—A leaflet advertising the company's "Elasta" electric lamps.

MESSRS. ROYLES, LTD., Irlam, near Manchester.—An illustrated brochure dealing with "Milletherm" feed water heaters.

THE IGRANIC ELECTRIC CO., LTD., 149, Queen Victoria Street, E.C.4.—Publication No. 6,213, containing full details, illustrations and prices of "Igranic" and "Igranic-Pacent" radio apparatus.

THE CAMBRIDGE INSTRUMENT CO., LTD., 45, Grosvenor Place, S.W.1.—A mailing card advertising six booklets which the company has published dealing with its instruments.

M. PAUL DIENY, 21, Laurence Pountney Lane, E.C.4.—A price list of brown and black bakelite sheet.

Bankruptcy Proceedings.—F. J. TIZZARD and N. TIZZARD (Tizzard Bros.), electrical engineers and contractors, 27, Dalkeith Street, Barrow-in-Furness, and 21, Market Street, Dalton-in-Furness.—Last day for proofs for dividend, March 6th. Trustee, Mr. W. G. Pearson, Official Receiver, 16, Cornwallis Street, Barrow-in-Furness.

G. W. RIDLEY, electrical engineer and contractor, 1, Alfred's Court, Chorley.—Last day for proofs for dividend, March 5th. Trustee, Mr. H. Parker, Official Receiver, 11, Winckley Street, Preston.

R. WRIGHT (R. Wright & Co.), electrical engineer, 34-36, Oxford Street, W.—Trustee, Mr. R. F. W. Fincham, 3, Warwick Court, Grays Inn, W.C., released February 2nd.

W. T. ELLIS and C. A. HORNSBY (Ellis & Hornsby), electrical engineers, Gwynfryn, Deganwy Avenue, Llandudno. Trustee, Mr. I. D. Hooson, Official Receiver, St. Peter's Churchyard, The Cross, Chester, released February 8th.

A. SMITH (Smith & Gill), electrician, 57, Albion Street, Nelson.—Trustee, Mr. H. Parker, Official Receiver, 11, Winckley Square, Preston, released February 5th.

J. A. BOSHER, electrical engineer and contractor, 33, High Street, Aberdare.—Last day for proofs for dividend, March 2nd. Trustee, Mr. S. E. Clutterbuck, 31, Queen Street, Cardiff.

G. V. COOKE (Wakefield Welding Co. and the Albion Accumulator Service), oxy-acetylene welder and accumulator charger.—Receiving order made February 13th, on debtor's own petition. First meeting March 1st, at the Official Receiver's Office, 21, King Street, Wakefield. Public examination, March 11th, at the Court House, Wakefield.

H. W. W. ALFORD, wireless engineer, 13, Goldsmith Street, and 261, High Street, Exeter.—Trustee, Mr. W. R. Cocks, Official Receiver, Exeter Bank Chambers, 67, High Street, Exeter, released February 4th.

J. BURKETT, electrical engineer, 185, John Clay Street, and 78, Anderson Street, South Shields.—Trustee, Mr. C. Woollett, Official Receiver, Pearl Buildings, 4, Northumberland Street, Newcastle-on-Tyne, released February 5th, 1926.

E. DOWNING, lately carrying on business in co-partnership with E. J. Mills, as manufacturers of electrical conduit fittings, late of 143, Butts Road, Walsall.—Trustee, Mr. S. W. Page, Official Receiver, 30, Lichfield Street, Wolverhampton, released February 9th.

W. T. SMITH, electrical and mechanical engineer, Victoria Street, and 61, Hampden Street, Bolton.—Last day for proofs for dividend, March 3rd. Trustee, Mr. J. G. Gibson, Official Receiver, Byrom Street, Manchester.

Company Liquidations.—PRESSLAND ELECTRIC SUPPLIES, LTD., wholesale electrical and radio factors, Eden Street, Kingston-on-Thames.—A meeting of creditors was held recently at Kingston-on-Thames. The chair was occupied by Mr. W. Bronson, I.A., of 157, Cricklade Avenue, S.W., who had been appointed to act as the liquidator in the voluntary liquidation of the company. An approximate statement of affairs as at December 31st last disclosed ranking liabilities of £10,729 and assets estimated to realise £13,556. From that amount had to be deducted £8,800 due on debentures, leaving net assets of £4,756, or a deficiency as regarded the creditors of £5,973. The company had made advances to another radio company to the extent of £2,134, but at the moment it was not known what amount would be recovered. Mr. Bronson reported that the company was registered on December 6th, 1922, with a nominal capital of £1,100, all of which had been issued for cash. The directors of the company were Messrs. C. Pressland and H. W. Matton, who were also the only shareholders. The company traded successfully up to June, 1924, when it was in need of further capital. Up to that date Mr. Matton had advanced cash to the extent of £3,500, and he then lent a further £2,500, and as security was given debentures over the assets for £6,000. In January the interest on the debentures was in arrears, and Mr. F. W. Stevens was appointed as receiver. It appeared that the company had made advances to another wireless concern, and had received a debenture for £2,800. Between January 1st, 1923, and December 31st last, the total sales of the company amounted to £75,000, but Mr. Bronson said he was of the opinion that the gross profits earned during the period had been exceeded by the overhead expenses, and that there had been a net loss on the trading. In the course of a discussion it was pointed out that debentures had been issued for more than the amount of the company's capital, and it might be that some portion of the debentures could not be regarded as constituting a first charge over the assets. A resolution was proposed in favour of the voluntary liquidation of the company being continued, with Mr. Bronson as liquidator. Mr. Bronson stated that on the proxies lodged his appointment as liquidator was confirmed. A suggestion was made by one creditor that the meeting should be adjourned with a view to a compulsory petition being presented, but this was not agreed to.

RADIO EQUIPMENT CO., LTD.—A petition for the winding up of this company has been presented to the High Court by Marconi's Wireless Telegraph Co., Ltd., of Marconi House, Strand, W.C. Creditors will be heard in London on March 2nd.

RADIO WORKS, LTD.—Winding up voluntarily. Liquidator, Mr. R. L. Tayler, Coventry House, South Place, E.C.2. A meeting of creditors was called for February 25th at the Liquidator's offices.

ERITH ELECTRICAL CO., LTD.—Winding up voluntarily. Liquidator, Mr. H. C. Merrit, 41, Finsbury Square, E.C. Meeting of creditors, March 1st, at the Institute of Chartered Accountants, Moorgate Place, E.C. Particulars of claims to the Liquidator by April 1st.

Dissolutions of Partnership.—A. G. BULLEN & CO., electricians, 79, West Walls, Carlisle.—Messrs. A. G. Bullen and R. L. Jenkinson have dissolved partnership. Debts will be attended to by Mr. Bullen, who will continue the business under the same style.

TAYLOR & ANDERSON, electricians, Talbot Street, Grangemouth.—Messrs. R. Taylor and R. Anderson have dissolved partnership. Mr. Anderson will continue the business.

Deed of Assignment.—W. W. SYMPER and D. J. EVERSHED (Symper & Evershed), electrical engineers, 22-24, Greenhill Parade, Harrow-on-the-Hill. Particulars of claims to the Trustee, Mr. W. A. J. Osborne, Balfour House, Finsbury Pavement, E.C.2, by March 9th.

Meeting of Creditors.—COLE, MARCHENT & MORLEY, LTD.—A meeting of creditors was held at the offices of the company on February 16th. Mr. A. Greaves, the company's accountant, presented a statement of affairs, which showed liabilities to unsecured creditors of £54,522, along with contingent liabilities of £20,000, and second debentures for £71,000. The assets covered by the first debentures, land, buildings, motive power, &c., were taken at book value, *viz.*, £72,396, leaving a surplus of £57,278. The balance of assets after deducting the second debentures showed a surplus of £55,801, less the amount due to unsecured creditors £54,522, leaving a surplus of £1,279. Mr. Greaves emphasised the fact that the assets taken at book value had recently been valued at a much larger sum on the basis of a going concern, but that the realisable value was problematical, depending entirely upon the mode of realisation. After discussion, the creditors passed a resolution leaving the matter in the hands of the receivers (Messrs. A. Greaves and R. S. Brailsford), and appointed a committee to whom the receivers will report from time to time. The opinion was expressed that it was not advisable in the interest of the creditors for any steps to be taken by any creditor to place the company in liquidation.

Railway Electricians' Dispute Settled.—The threatened strike of electricians employed in the power and sub-stations of the London electric railways has been averted by the concession by the companies of the 6¼ per cent. increase which was recently awarded to all electricity supply workers in the London area.

Local Exhibition. — BURNLEY. — The recent exhibition organised by the Electricity Committee produced satisfactory results. It was visited by 21,206 persons, and £108 was received in admission fees. The appliances disposed of were: Cookers, 52; radiators, 56; vacuum cleaners, 21; "Santon" geysers, 12; wash boilers, 10; sewing machines, 8; sundry appliances (irons, kettles, bed-warmers, &c.), 60.

Catalogues Wanted.—MR. T. H. M. SWINBURNE, electrical engineer and merchant, Ellesmere Road, Altrincham, asks for catalogues and price lists of electrical goods of all kinds, with wholesalers' terms.

Wireless Exhibition, Olympia, 1926.—We learn that the Wireless Exhibition to be promoted by the N.A.R.M.A.T. will be held in the new Hall, Olympia, from September 4th to 18th next (both inclusive), and that it will be thrown open to the trade as a whole. It is hoped that such support will be afforded the forthcoming Exhibition as will make it fully representative of the British radio industry.

Contract Conditions.—With reference to the I.E.E. Model Form of General Conditions "A" (Home-With Erection), we learn that Clause 37 (Regulations of Local Authorities) of the edition (revised September, 1921) has been amended by the Council to make it clear that the regulations and by-laws with which the contractor shall conform are those which the local or other authorities are authorised by Statute to make. In Clause 37 of the new edition (revised January, 1926) the words "which they are authorised by Statute to make and" have been inserted after the word "authorities." The new edition in all other respects conforms with the old edition.

A Telephone Directory.—MR. J. C. WHITE (Manchester) has sent his customers a useful desk telephone directory with ample space for memoranda.

Steam Turbines for South America.—The Compania Hispano-Americana de Electricidad has contracted with the International General Electric Company for two 52,500-kW, tandem-compound steam turbine generators as the initial installation for the new generating station to be built at the entrance of the harbour of Buenos Aires. Each generator will be a 50,000-kW, 13,200-V, 1,500-r.p.m. main unit with a 250-V d.c. exciter and a 2,500-kW, 2,300-V service generator with its own d.c. exciter, all mounted on the same shaft. The turbines will operate at an initial steam pressure of 550 lb. gauge and 750 deg. F. total temperature, with full intermediate reheat of the steam between the cylinders.

Swedish Refrigerating Apparatus Development.—According to the papers, the Aktiebolaget Elektrolux has received a communication from America stating that a definite agreement has been concluded with a leading American manufacturer of refrigerating apparatus regarding the exploitation of the remarkable Swedish invention in this branch made by the two young engineers, Messrs. Platen and Munters. Aktiebolaget Elektrolux will receive a sufficient number of shares in the American exploiting company to assure its control over the company, together with a sum in cash and a royalty on production. Companies affiliated to Elektrolux have been founded in Germany and France in order to create markets for the new invention and other products of the company. Factories will be erected or leased in Berlin and Paris for the manufacture of cupboards for refrigerating apparatus, while these will be produced to the largest possible extent in Sweden.—*Reuter's Trade Service* (Stockholm).

The "Electrolux" refrigerator is described elsewhere in this issue. A factory is to be built at Luton for its manufacture.

For Sale.—Newquay Electric Light and Power Co., Ltd., invites offers for two Belliss & Morcom compound non-condensing engines, direct-coupled to two 500-volt d.c. generators, two Stirling boilers with superheaters, and two Weir feed pumps, valves, piping, &c. The Royal Kinema, Tonypandy, has for disposal one 18-h.p. motor generator set. The Palace Pier Co., Brighton, invites offers for two Otis electric passenger lifts. By order of the High Court, Messrs. H. Butcher and Co. invite offers for the nautical and scientific instrument works of Heath & Co., Ltd., Avery Hill Road, New Eltham, comprising freehold land, buildings, plant, machinery, stock-in-trade, &c. (See our advertisement pages to-day.)

Book Notices.—"Weaving and Woven Fabrics." Pp. 710; illustrated. London: Lewenz & Wilkinson, Ltd. Price 41s.—This is Vol. XVI of the Schlomann-Oldenbourg illustrated technical dictionaries, and covers that section of the textile industry which is of chief interest to electrical engineers—namely, the applications of electricity to driving the machinery, and the motors and accessories employed. It is true that the electrical references form but a small part of this volume, which covers a vast number of technical terms and forms a very useful and worthy addition to a series of dictionaries that is without a rival. The book is of a more convenient shape than the earlier volumes, and the six languages covered are provided with separate indexes, instead of being run together alphabetically. We cannot speak too highly of the Schlomann dictionaries, which are indispensable to those who have occasion to translate technical articles and data.

The following pamphlets have been published by the Technical Section of the Association of Engineering and Shipbuilding Draughtsmen, 96, St. George's Square, London, S.W.1, during the present session 1925-26:—"Rolling-Mill Machinery," by R. C. D. Fell; "Foundations," by W. H. Latham; "Perspective Drawing for Draughtsmen," by W. Sellar. Many examples of electrically-driven machines are cited in the publication by Mr. Fell. The price of each publication to the public is 2s.

"Who's Who in Architecture," for 1926. London: The Architectural Press. Price, 25s. net.—The publication of this year's edition has been expressly timed to coincide with the recently concluded amalgamation of the Society of Architects and the Royal Institute of British Architects, and the new volume includes the numerous qualification changes which this most important event has brought in its train. The new issue has been carefully revised, and its biographical notices of the British architects have been compiled with the greatest care under the editorship of Mr. Fredk. Chatterton, F.R.I.B.A.

"Theory and Practice of Alternating Currents," by A. T. Dover. Pp. xv+539; 303 figs. London: Sir Isaac Pitman and Sons, Ltd. Price 18s. net.

"*Journal* of the Institution of Electrical Engineers." Vol. LXIV, February, 1926, No. 350. London: E. & F. N. Spon, Ltd. Price 10s. 6d.

New French Company.—La Société d'Electrification Rurale de Lesuere-Jaoul is the name of a new concern which has lately been formed at Rodez with a capital of 664,700 fr., to establish a hydro-electric station upon Jaoul falls.

A German Merger.—It is reported from Stuttgart that the business of the Eisemann Gesellschaft has been amalgamated with that of the Robert Bosch Gesellschaft of that town. Both concerns are well known as manufacturers of magnetos, sparking plugs and other electrical equipment for motor vehicles.

Swedish Agreements with Russia.—Besides the agreements entered into between the A.E.G. and the Soviet State Electrical Trust (heavy electrical engineering branches), to which reference was recently made, it is now announced that in the matter of light electrical engineering manufactures, a licence and sales agreement has also been concluded for a period of six years between the Swedish Ericsson Company and the Soviet Low Pressure Trust. The latter is said to have been granted the exclusive right of using all the patents of the Swedish company also in Esthonia, Latvia, Lithuania, Persia, Afghanistan and Mongolia. Moreover, the sole right of sales for all the products of the Swedish company is reported to have been granted for the countries in question with the exception of Esthonia, Latvia and Lithuania, and a credit of 3,000,000 kr. with the Swedish company in the case of possible orders given by the Trust. In return, the Swedish company will receive a payment of from 2 to 4 per cent. of the value of all installations carried out by the Trust on the basis of the agreement.

New Italian Companies.—Among the new electricity supply undertakings recently organised in Italy are the Società Idro-Elettrica Sile, of Treviso, capital 100,000 lire, and the Società di Elettricità, of Genoa, capital one million lire.

Irish Free State Electrical Imports.—The imports of electrical goods into the Irish Free State during November last attained a value of £48,166, as compared with £35,434 in the corresponding period of 1924. For the first eleven months of 1925 the returns show a total of £356,181, as against £364,703. It should be noted that the imports of electrical machinery are not included in the above figures.

Copper, Lead and Rubber Prices.—Messrs. F. Smith and Co. report February 23rd:—No change in the prices of electrolytic copper.

Messrs. James & Shakespeare report February 23rd:—Copper bars (best selected) sheet and rod, no change; English pig lead, £35 5s., 5s. decrease.

Messrs. Edward Till & Co. report February 23rd:—India-rubber, Para, fine, 2s. 3d., 4d. decrease.

Tramway Extensions in Argentina.—It is reported that the Rosario Municipality is contemplating the extension of its tramway system into outlying districts. The cost is estimated at 2,500,000 pesos (approximately £59,000).

Large Machinery Production in Czecho-Slovakia. — The Skoda Works Co., of Pilsen, has recently completed a 20,000-h.p. steam turbine and dynamo, designed to run at 3,000 r.p.m., for the municipal power station in Prague.

Lighting Propaganda in France.—With the object of encouraging the improvement of lighting throughout France, a number of electricity supply undertakings and makers of electric lamps and other fittings in that country have recently organised the Société pour le Perfectionnement de l'Eclairage, with headquarters at 12, Rue Pelleport, Paris. The new organisation has for its object the collection, co-ordination and broadcasting of information relative to lighting, to train-lighting specialists; to inaugurate a campaign in favour of better lighting; to explain and demonstrate by conferences, leaflets and tests the principles on which modern lighting installations should be based, &c. It is proposed to establish a showroom for modern electric lighting equipment and to establish a journal with the title *Eclairagisme* to deal specially with lighting matters.

Lighting and Power Notes.

Aire and Calder Electricity District.—The conference of local authorities of the West Riding of Yorkshire (Aire and Calder) Electricity District held a meeting on February 17th, at the Bradford town hall, when there were present representatives from Bradford, Halifax, Dewsbury, Huddersfield, Barnsley, Wakefield, Keighley, Batley, Shipley, Ilkley and Hebden Bridge. The present position in relation to the long-deferred proposed Aire and Calder scheme, and the position in regard to supply demands, or proposals in various West Yorkshire districts, were discussed. The conference was again adjourned, to a date to be fixed by the executive committee, and no statement of the proceedings was issued for publication.

Australia.—SYDNEY (N.S.W.).—According to the *Australasian Electrical Times*, in order to provide for the increase in the demand for electricity for about ten years, approval has been given by the City Council to the laying of underground h.p. cables at a cost of £1,542,000 to replace the existing h.p. overhead mains. The amount is to be expended during the next four years, in the following proportions:—1926, £376,000; 1927, £293,000; 1928, £479,000; 1929, £394,000.

NEW SOUTH WALES.—*Tenders* states that included in the State treasurer's estimates for the forthcoming year are the following items:—Hydro-electric schemes, £85,500; Burrinjuck dam development works, £208,700.

Barnsley.—LOAN.—The Town Council is applying for sanction to a loan of £42,000 for the laying of mains and other purposes.

Blackpool.—ELECTRICITY AGREEMENT.—The draft agreement with the Corporation for the supply of electricity to Poulton, Carleton and Marton has been revised and the amended document has been forwarded to the Corporation for ratification.

Blyth.—NEW POWER STATION.—The Northern Counties Electricity Supply Co., Ltd., is to erect a power station at Newsham, Blyth.

Canada.—HYDRO-ELECTRIC DEVELOPMENT.—Development of the Alexander Falls on the Nipigon River, at an estimated cost of nearly $7,000,000, is to be carried out by the Ontario Hydro-Electric Power Commission, authority for the development having been granted. This development, which has been made necessary through increased demands for power from the industrial interests in the Thunder Bay district, will add 50,000 h.p. to the present supply of 65,000 h.p. available at Cameron Falls, one and a-half miles north of Alexander, and will enable the Government to take ample care of the situation at the head of the lakes until 1930 or 1931. Operation at the new power site will begin in 1928. Its complete power capacity, according to the Premier, has been applied for already. Ontario's investment on the Nipigon represents $12,000,000, which is approximately $1,000,000 less than the amount which was estimated by the Hydro-Electric Commission as required.

Continental.—FRANCE.—The French Ministry of Public Works has recently granted a concession to the Société d'Energie Electrique de l'Emblavez of Lavoute-sur-Loire, to establish a hydro-electric station to utilise the water power of the River Loire in the Department of Haute Loire.

The report of the Société Electrique du Nord-Ouest for the past year shows a steady increase in the use of electricity for lighting and power purposes in North-West France, the sales of the company having increased from 80,629,347 kWh in 1924 to 88,283,010 kWh last year. During the year a 90,000-V transmission line was erected between Bully and Gosnay and between Bully and Dainville for the supply of electricity to the Arras district.

LUXEMBOURG.—Plans have been prepared for the construction of two large hydro-electric stations to utilise the water power of the River Our, one at Holzentry and the other near Vinden.

SPAIN.—The Sociedad de Canalazacion y Fuerzas de Guadalquivir has recently commenced the construction of another dam below the Jandula falls which will supply water to a new hydro-electric station with a capacity of 26,000 h.p.

Cottingham.—ELECTRICITY IN BULK.—The Urban District Council has received an offer of a bulk supply of electricity from Hull Corporation, and has appointed a deputation to meet the Corporation with a view to obtaining further information as to the estimated cost.

Cumnock.—ELECTRICITY SUPPLY.—The Town Council has accepted the offer of the Ayrshire Electricity Board for an electricity supply and is to allow overhead cables to be installed.

Dartford.—LOAN.—The Electricity Committee has recommended to the Urban District Council that application be made for sanction to a loan of £33,480 for electricity extensions.

Edinburgh.—STREET LIGHTING.—The Corporation Lighting Committee has recommended that provision be made for improved street lighting. The scheme includes the provision of 800 new electric lamps, while a number of the old lamps are to be fitted with Holophane glassware. The wattage of lamps in side streets in various districts is to be increased.

Epping.—ELECTRICITY SUPPLY.—The Urban District Council has consented to the application of the North Metropolitan Electric Power Supply Co. for a Special Order to supply electricity in the district. No overhead wires are to be erected in the town, and the maximum charges are to be 10d. per kWh for lighting and 1½d. per kWh for heating.

Glasgow.—PROGRESS DURING JANUARY.—The manager of the Corporation electricity undertaking reports that 104 houses were wired in January, making the total to date 1813, and that the number of applications for the hire of domestic appliances was 216, making the total to date 9,819.

Heywood.—NEW PLANT.—The Town Council is to install a 750-kW rotary converter at the power station, and application is being made for sanction to a loan of £4,600 to cover the cost of the plant.

Holmfirth.—EXTENSION OF SUPPLY.—The Urban District Council has approved a scheme for electricity extensions, and application is being made for sanction to borrow £5,000.

Hornsey.—LOANS.—The Electricity Committee has recommended that application be made for sanction to loans of £1,000 for extensions and £9,000 for services.

Ipswich.—ELECTRICITY EXTENSIONS.—The Town Council has adopted a report submitted by the Electric Supply and Transport Committee on electricity extensions. Two 2,000-kW rotary converters are to be installed at an estimated cost of £16,000, and additional d.c. feeders are to be laid from the power station to Stoke Bridge, Major's Corner, and Barrack Corner at a cost of £15,700.

Irish Free State.—BALLINA (CO. MAYO).—A scheme for supplying electricity for public and private lighting in the town is about to be undertaken by Mr. T. J. Reid, of the Gas Works, Ballina, who has applied to the Ministry of Industry and Commerce for a Special Order to enable him to carry the proposed scheme into effect.

HOWTH (CO. DUBLIN).—The Urban District Council proposes to have the electric lighting system extended and to introduce facilities for domestic lighting.

Kent.—ELECTRICITY SCHEME.—The *Evening News* states that Messrs. Pearson & Dorman Long, Ltd., are to spend £2,000,000 on the development of the Kentish coalfield, and it is reported that plans have been prepared for the generation of electricity and for its transmission to London.

Leominster.—ELECTRICITY IN BULK.—The Electricity Commissioners have approved the supplementary agreement of the Hereford Corporation for a supply of electricity in bulk to the Leominster Electric Supply Co., Ltd.

Lichfield.—LOAN SANCTIONED.—The Town Council has received sanction to a loan of £28,700 in connection with the electricity scheme.

London.—BERMONDSEY.—The Electricity Committee has received sanction to the borrowing of £21,500 for mains, meters, and domestic apparatus.

Maidstone.—EXTENSION OF SUPPLY.—The Corporation is to extend its cables from the Snodland Paper Mills to a new cement factory at Holborough. It is stated that this will mean an additional supply of electricity from Maidstone of about 6,000,000 kWh per annum.

Mansfield.—NEW SUB-STATION.—The Town Council has received an application for a supply of electricity to a factory in course of erection in Sutton Road, and is to provide a sub-station at a cost of £1,000 for the supply of electricity in that district.

Nottingham.—ELECTRICITY CHARGES.—The Electricity Committee has agreed to place arc projectors and generators in kinemas on the power rate of 2½d. per kWh, instead of the present rate of 5½d. per kWh.

Padiham.—ELECTRICITY SUPPLY.—The Lancashire Electric Power Co. has erected overhead cables from Accrington electricity works to the new power station at Padiham, and is now taking electricity from Accrington to supply certain areas in Padiham district, pending the completion of the new Padiham station. Electricity is transmitted at 10,000 V.

Preesal.—LOAN.—Application is being made by the Urban District Council for sanction to a loan of £1,000 for the purchase of domestic apparatus to be let out on hire.

Preston.—LOAN.—The Electricity Committee has recommended that application be made for sanction to the borrowing of £10,000 for the purchase of cookers, &c., to be let out on hire.

Portsmouth.—ELECTRICITY CHARGES.—The Electric Lighting Committee has revised the scale of charges for lighting as follows:—Within the borough: First 5,000 kWh per annum, 5½d. per kWh; from 5,000 to 10,000 kWh, 5d.; 10,000 to 20,000 kWh, 4d.; 20,000 to 30,000 kWh, 3½d.; 30,000 to 40,000 kWh, 3d.; 40,000 to 50,000 kWh, 2d.; any quantity above 50,000 kWh per annum, 1½d. per kWh. Outside the borough, 2d. per kWh extra in each case.

Rothesay.—NEW POWER STATION.—The Town Council proposes to erect its own power station for the supply of electricity in the town. Electricity is at present obtained from the Rothesay Tramway Co., Ltd.

Rugeley.—ELECTRICITY SUPPLY.—It has been reported to the Urban District Council that Major Prescott-Westcar has decided not to proceed further with his application for a Special Order, but that the Power Development Co., of London, is considering the question of making an application in association with Messrs. Rooper & Chalmers. The Council has decided to ask the Power Development Co. for particulars of its scheme.

Sittingbourne.—ELECTRICITY SUPPLY.—The Urban District Council has been informed by the Kent Electric Power Co. of its inability to supply electricity to the town at present. Messrs. E. Lloyd, Ltd., who had also been approached on the matter, have replied that they cannot give a supply, and the Sheerness Electric Power Co. has now been approached with a view to obtaining a supply from its works.

South-East Lancashire.—ELECTRICITY ADVISORY BOARD.—The Board has intimated to Alderley Edge Urban District Council that it is considering supplying electricity in bulk through the Alderley and Wilmslow Electricity Supply Co., and also the attitude to adopt in any action initiated by local authorities with the object of securing a reduction in the charge of 10d. per kWh at present made by the company.

Special Orders.—The Electricity Commissioners have submitted to the Minister of Transport for confirmation a Special Order made by them authorising the Richmond (Yorks.) Town Council to supply electricity in the borough and rural district of Richmond.

Application has been made by Mr. R. F. Winder for a Special Order to supply electricity in Boroughbridge (Yorks.) and district.

The Minister of Transport has confirmed Special Orders made by the Electricity Commissioners authorising the Birmingham Corporation to supply electricity in the rural district of Solihull and part of the rural district of Meriden, and the St. Helens Corporation to supply in part of the rural district of Whiston.

Stanhope (Co. Durham).—ELECTRICITY SCHEME.—In connection with the Urban District Council's scheme for the electrification of the whole of Weardale, the engineer has submitted a report based on obtaining a bulk supply from the Cleveland and Durham County Electric Power Co. at Peases West, Crook, and transmitting it at a pressure of 19,000 V to Wolsingham, from which centre it would be distributed to all parts of Weardale, a total distance of 21 miles. The preliminary estimates show the cost to be about £33,000.

Thornaby-on-Tees.—STREET LIGHTING.—The Corporation is of opinion that it might encourage private consumers to take a supply of electricity if the service were adopted for street lighting, and it was agreed to obtain from the Cleveland and Durham County Electric Power Co. an estimate of the cost of laying mains for lighting certain streets by electricity.

United States.—ELECTRICAL DEVELOPMENTS.—According to *Power*, the improvement and extension programme of the Columbus Railway Power & Light Co., Columbus, Ohio, involving an expenditure of $11,000,000, will be completed by the company this year. Some of this work has been in hand for two years. Other work expected to cost $3,000,000 will be started this year. The new Pickaway power plant, erected about 11 miles south of Columbus in Pickaway County, at a cost of $7,000,000, with provision for more than doubling its capacity at a total cost of over $16,000,000, is being erected. This plant will have a capacity of 60,000 kW when it is placed in service this year. Additional units will be installed as needed to bring its total capacity to 150,000 kW.

An application for a preliminary permit covering the Cove Creek site on Clinch and Powell rivers in the Tennessee Valley, has been filed with the Federal Power Commission by the Union Carbide Co., of Richmond, Va., a subsidiary of the Union Carbide & Carbon Co., of New York. The Company's plans call for a maximum development of this important site. It is proposed to build four dams and power houses. The installation proposed at the power houses is 30,000 h.p., 50,000 h.p., 13,000 h.p., and 200,000 h.p.

Whaley Bridge.—ELECTRICITY SCHEME.—The Urban Council has referred to the South-East Lancashire Electricity Advisory Board a letter from the Power Development Company, London, asking for the Council's support to an application for an Order to supply electricity in the rural district of Chapel-en-le-Frith and the urban district of Whaley Bridge.

Worsborough.—WIRING OF SMALL HOUSES.—The Urban District Council has received a report from the Electrical Distribution of Yorkshire, Ltd., on the wiring of 40 houses on the Back End site. The company states that the cost of connecting these houses with the sub-station would be £1,350, and it suggests levying a charge of £2 per house for the service connection. The charge through quarterly meters would be 6½d. per kWh and through slot meters, 7½d. per kWh.

Tramway and Railway Notes.

Bradford.—NEW TRAMCAR DESIGN.—The Tramways Committee has authorised Mr. R. H. Wilkinson (general manager) to proceed with the construction of a single-deck saloon tramcar, divided into smoking and non-smoking compartments, which will be entirely new to Bradford. The cost will be about £2,000, the seating capacity 40, and the speed capacity appreciably greater than that of the existing double-deck cars. The car, which is to Mr. Wilkinson's own design, will run on two four-wheel bogeys. The conductor will be in the middle of the saloon, at a central entrance, and there will be no screen between driver and passengers.

Continental.—SPAIN.—The Spanish Department of Communications has recently placed the contract for the supply of the electrical energy for the electrified railway between Ripoll and Aix-les-Thermes in the Pyrennees, with the Sociedad Energia Electrica de Catalune, of Barcelona.

FRANCE.—Contracts have been placed for the construction of two new sections of the Paris underground electric railways.

Good progress is being made with the electrification of the Culoz-Modane Section of the Paris, Lyons and Mediterranean railway. The transformer stations at Aix-les-Bains, Chambery, Saint Pierre-d'Albigny and Saint Jean de Maurienne have already been completed, and the erection of the 45,000-V line between Venihon and Chambery to feed these stations is well in hand. The third rail has been laid between Chambery and St. Pierre-d'Albigny, and electric locomotives are now running on the Chambery-Montmelian section, current being drawn from the Chambery transformer station which is being temporarily supplied from the Departmental electricity transmission system.

Greenock.—ELECTRICITY ACCOUNTS DISPUTE.—The *Greenock Telegraph* states that a difference of opinion has arisen between the Corporation and the Greenock and Port Glasgow Tramway Co. regarding the payment of electricity accounts. Under the arbiters' award the Corporation is satisfied that a minimum payment of £5,000 per annum was fixed, but this is disputed by the Company. The Electricity Committee has recommended that the Corporation should insist upon full payment of the amount specified in the award and for recovery of arrears.

London.—L.C.C. TRAMWAY IMPROVEMENTS.—Double-deck L.C.C. tramcars are to replace single-deck cars on the Chelsea Bridge to Lavender Hill route in a few weeks' time. The road is being lowered by 18 inches underneath the Southern Railway arches near Queen's Road station to allow the larger cars to pass.

TRAMCAR IMPROVEMENTS.—A tramway-car reconstructed with special consideration for the comfort of passengers has been put into service on the Enfield to Euston route of the Metropolitan Electric Tramways, Ltd. It has been fitted with the latest type of cross seating, well-sprung seats being arranged with reversible backs, so that passengers may always face the direction in which the car is proceeding. In place of the usual slatted floor, the lower saloon floor has been covered with rubber. Six cars are being reconstructed in a similar manner for service on various routes.

Madagascar.—RAILWAY ELECTRIFICATION.—A *Reuter* message from Paris states that the Governor-General of Madagascar intends to submit to the French Government an important programme for the further development of Madagascar, which includes the electrification of the Antananarivo-Tamatave railway and the construction of an electric railway linking up the densely-populated Betsileo district with the east coast.

Preston.—TRAMWAY IMPROVEMENTS.—The Tramways Committee has recommended permanent-way renewals at a cost of £4,900, and car renewals at a cost of £3,920.

Salford.—THROUGH-RUNNING.—The *Electric Railway and Tramway Journal* states that, following upon the establishment of the tramway service between Victoria Bridge and Bury, the Tramways Committee has had under consideration means of making further extensions to its services. The latest suggestion is that a service shall be run from Salford to Walkden. The present traffic in Walkden is under the control of the Lancashire United Tramway Co., and the Tramways Committee has decided to open negotiations with that company, the object in view being an interchange of services similar to that which now exists between Salford and Bury. At a later date the Committee hopes to proceed with the establishment of a similar service between Salford and Bolton.

Telegraph and Telephone Notes.

China.—CABLE RATES INCREASED.—The Chinese Telegraph Administration at Harbin recently increased by 20 per cent. the cable charges on telegrams to foreign countries. Charges are payable in local paper dollars.

Czecho-Slovakia.—LONG-DISTANCE TELEPHONY.—The Ministry of Posts and Telegraphs has arrived at an agreement with the French and German telegraph authorities for the installation of a direct telephone service between Prague and Paris. The project is to be carried into effect this summer. The *Financial Times* thinks it probable that as soon as the service is inaugurated the charge for a three minutes' conversation will be reduced from 10 to 8.60 fr., as the expenses now involved by the use of the relaying station at Frankfurt will no longer be incurred.

Dominica.—TELEPHONE SYSTEM.—The Municipal Council of Santiago, Dominican Republic, has sanctioned a proposal for the establishment in Santiago of a modern telephone system for a minimum of 500 subscribers.—*Reuter's Trade Service* (Port-au-Prince).

France.—INTERNATIONAL TELEGRAPH AND TELEPHONE RATES.—As from February 16th the standard international telegraph and telephone rates will be multiplied by 5.2, as compared with 5.1, the figure fixed on January 16th. The rate is still lower than that which came into force on January 6th, when a figure of 5.3 was established, as compared with 5 in December, 1925.—*Reuter* (Paris).

Honduras.—TELEPHONE SYSTEM.—The Government of Honduras has entered into a contract for the construction of a telephone line, 175 miles in length from the capital (Tegucigalpa) to San Pedro Sula, running along the eastern shore of Lake Yojoa, the contractors undertaking to have the service in working order before the middle of September. The same firm has been granted a concession to construct a line from Tegucigalpa to Yorro, with branches at Trujillo, Olanchito, La Ceiba, &c.—*Reuter's Trade Service* (Tegucigalpa).

Hull Telephone Service.—RELIEF OF RATES.—Hull Corporation Telephone Committee has decided to give a sum of about £1,700, representing one-half per cent. of the undertaking's liquid loans, in the relief of the city rates. The chairman said it would be advisable, in view of the difficulty of estimating the year's developments in expenditure, for the undertaking to be abundantly safe. It might be, too, that at the end of the year the Government would take over the undertaking.

Iraq.—TELEPHONE SERVICE.—The telephone service in Iraq is still in its infancy. There are no long-distance lines, and the only cities having telephone systems are Baghdad, Mosul, and Basra. Baghdad, a city of 250,000 population, has about 400 subscribers, and the annual rate is 440 rupees (nearly £35). In Mosul, a city of about 60,000 people, the use of the telephone is limited almost entirely to the British military and Iraq Government Services. The Basra automatic system was installed by the British army of occupation, and gives ample facilities. The rates (now about 400 rupees) will probably be decreased shortly in order to attract subscribers.

Marine Radio Operators.—STRIKE SETTLED.—The marine wireless operators' strike was settled at the Ministry of Labour on February 18th, and work was to be resumed immediately. The strike began on November 26th last, when the men declared that the employers failed to consider certain questions raised by the men's association on which satisfaction was desired before negotiating with regard to a proposal by the shipowners to reduce wages by 22s. 6d. a month. The resumption of work was to take place on the new rates of pay, at the reduction of 22s. 6d. a month demanded by the employers. The whole of the matters in dispute, including wages, are to be the subject of negotiation after the resumption of work, and if no settlement is reached the questions in dispute are to be referred to arbitration.

Radio-Telegraph Convention.—NEW MEMBERS.—It is announced that the Côte Français des Somalis and the Republic of Honduras have become members of the Radio-Telegraph Convention.

Radio Notes.

Broadcasting Committee.—REPORT.—The Broadcasting Committee, appointed by the Government under the chairmanship of the Earl of Crawford, was to meet at the House of Commons this week to frame its recommendations. Its report is expected to be in the hands of the Postmaster-General early next month.

Czecho-Slovakia.—GROWTH OF BROADCASTING.—The *Gazette de Prague* says that the first radio missions in Czecho-Slovakia were made in 1923, when trials were carried out in the spring at Kbely with 1-kW transmitting plant. On June 7th of that year the Radiojournal Company was created, with a capital of 500,000 crowns, of which the Radioslavia concern subscribed 255,000 crowns. At first operations were difficult as the only broadcasting station available (at Kbely) was constructed for telegraphy, and certain alterations had to be made. The first six concessions for receiving stations were granted on October 10th, 1923; on December 31st of that year 47 licences had been issued, at the end of 1924 the number was 1,564, and at present there are 32,000 listeners in Czecho-Slovakia. Since the inauguration of the Strasnice broadcasting station the number of listeners has increased considerably, and it is thought that the figure of 50,000 will be exceeded at the beginning of March.—*Reuter's Trade Service* (Prague).

Paraguay.—NEW STATION.—A radio-broadcasting station, erected under the auspices of the Military School at Asuncion, has been completed and a trial programme instituted.—*Reuter's Trade Service* (Asuncion).

United States.—G.E.C. RESEARCH.—There are now nine transmitters working on nine different wave-lengths from Schenectady, and during some periods seven may be "on the air" at the same time, not all broadcasting, however. Within three miles of the city the General Electric Co., of America, has constructed a transmitter development station; eight transmitters have been erected, each having its independent antenna system, which are constantly undergoing changes, and all transmitters are constructed on wooden frames so that they may be quickly dismantled as new methods are devised. The company is indebted to listeners who have reported on the various tests, notably the 50-kW broadcast tests and the programmes broadcast alternately from vertical and horizontal antennæ on superpower. Reports from volunteer listeners are supplemented by observations made by a corps of field engineers who are detailed to various parts of the country. Investigations at the South Schenectady station include short and long wave-lengths, code and broadcast signals, with various degrees of power input and a variety of antenna structures. Experimental broadcasting on special wave-lengths is finding increasing favour; Captain Calvin H. Burkhead, post signal officer, at Fort Leavenworth, Kansas, U.S.A., states that the 41.88-metre signals of WGY are received on a master receiver, and after amplification the signals are sent over 15 miles of wire to loud speakers in 162 homes. Development work on the 1,560-metre wave-length has shown that it is the "ideal" wave-length for reliable and consistent relay service over distances up to 300 miles.

POPULARITY OF RADIO.—A nation-wide survey of the radio industry made by Mr. Arthur Williams, vice-president of the New York Edison Co., shows that one of every three families in New York City and one of every five families in the rest of the United States owns a radio set. Radio sales have increased from 5,000,000 dollars to over 300,000,000 dollars in the last five years, and nearly 15,000,000 dollars were spent on broadcasting programmes last year. There are 22 broadcasting stations in the metropolitan area, and a total of 563 broadcasting stations throughout the United States.—*Reuter's Trade Service* (New York).

Contracts Open and Closed.

(The date given in parentheses at the end of the paragraph indicates the issue of the "Electrical Review" in which the "Official Notice" appeared in our advertisement pages.)

Open.

Australia.—SYDNEY.—March 31st. New South Wales Government Railways. One air compressor for Zarra Street power house.

April 21st. Four motor-generator sets and four switch-operating batteries for Hornsby and St. Leonards sub-station. Specifications from Chief Electrical Engineer, 61, Hunter Street, Sydney.

MELBOURNE.—April 7th. City Electrical Department. One 2,000-kW rotary converter, with transformer and accessories,* d.c. switchgear and accessories, and one a.c. control panel.*

April 7th. Victorian Government Railways. One hydraulic plate-bending press.* April 21st. Eight electric overhead travelling cranes.*

Bedford.—March 3rd. Electricity Department. E.h.p., h.p., and l.p. underground cables for 12 months. (February 19th.)

Belgium.—March 9th. Municipal authorities of Ixelles, Brussels. 6,000-kW steam turbo-generator set. Particulars for 3 fr. from Hotel Communal.

March 2nd. L.p. armoured cables and d.c. electricity meters. Particulars for 3 fr. from Hotel Communal.

March 4th. Municipal authorities of Schaerbeek, Brussels, 250-kVA transformer. Particulars for 5 fr. from Bureau du Service de l'Electricité, Hotel Communal, Schaerbeek.

Birmingham.—March 6th. Tramways Committee. Traction motors, power wiring, &c., for 30 tramcars. Form of tender from Mr. A. Baker, general manager, Tramway Offices, Council House, Congreve Street.

Bridlington. — March 10th. Electricity Department. Stores for 12 months, including electrical sundries, lamps, cables, &c. (See this issue.)

Cardiff.—March 8th. Electricity Department. One 10,000-kW turbo-alternator and condensing plant. (February 5th.)

Dundee.—Town Council. Tramway rails, tie-bars, fish-plate bolts and nuts. Specifications, &c., from Mr. Geo. Baxter, city engineer.

East Ham.—March 15th. Electric Lighting and Tramways Department. Cable, bifurcating boxes, and joint boxes. (See this issue.)

Eccles.—March 6th. Health Committee. Installation of electric lighting, including wiring and fittings, for houses being erected in Anson Street, Monton. Form of tender from Borough Electrical Engineer, Electricity Works, Cawdor Street.

Edinburgh.—March 8th. Electricity Supply Department. One 25,000-kW turbo-alternator with condensing plant, or alternatively, one 20,000-kW turbo-alternator with condensing plant. (February 5th.)

March 9th. Tramways Department. 1,200 tons of steel tramway rails. Specifications, &c., from Tramway Manager, 2, St. James' Square.

Hull.—Corporation Electricity Committee. Automatic table telephones and bell sets. (February 19th.)

India.—March 30th. India Store Department. Complete equipment for one rotary-converter sub-station, three separate rotary-converter sets and track sectioning switchgear for the G.I.P. Railway electrification. (See this issue.)

April 13th. 23 electric passenger locomotives. (See this issue.)

Kettering.—March 9th. Electricity Department. E.h.p. and l.p. cables. (See this issue.)

March 23rd. Transformers, e.h.p. and l.p. switchgear, one 1,500-kW rotary converter equipment, and one steam turbo-boiler feed pump. (See this issue.)

Leeds.—March 2nd. Tramways and Transport Department. Stores for year ending March 31st, 1927, including electrical sundries. Particulars from Mr. W. Chamberlain, general manager, 1, Swinegate.

Leicester.—Electricity Department. One 18,750-kW, 3-phase turbo-alternator, with condensing plant. (February 12th.)

Leytonstone.—West Ham Union. Alterations to the electric lighting station and the installation of a steam-driven generating set, &c., at the Central Home, Leytonstone. (February 19th.)

London.—ST. PANCRAS.—March 2nd. Electricity Department. E.h.p. switchgear at the Grafton Road sub-station. (February 5th.)

HOLBORN.—March 10th. Board of Guardians. Electrical fittings for six months. Forms of tender from Mr. C. J. Cross, Clerk to the Guardians, 53, Clerkenwell Road, E.C.1.

STEPNEY.—March 4th. Board of Guardians. Electrical fittings for six months. Mr. S. McClelland, clerk to the Guardians, Raine Street, Old Gravel Lane, E.1.

Manchester.—March 22nd. Electricity Department. 3-phase, 420-V sub-station switchgear, 3-phase, 6,600-V and 11,000-V ditto, three 500-kVA static transformers, and one 7,500-kVA forced-air-cooled transformer. (February 19th.)

March 22nd. One 5-ton electric tipping wagon and one 10-ton electric tractor with trailer. (See this issue.)

Newark-upon-Trent.—March 16th. Electricity Department. Medium and l.p. switchgear and accessories. (See this issue.)

New Zealand.—WELLINGTON.—April 23rd. Public Works Department. 11,000-V metering equipment and switchgear for the Arupuni electric power scheme.*

Oldham.—March 2nd. Electric lighting fittings at Bardsley Conservative Club. Particulars from Mr. E. W. Robins, secretary.

March 8th. Board of Guardians. Electric lamps and fittings. Form of tender from Mr. F. W. Fletcher, clerk to Board of Guardians, Union Offices.

Portsmouth.—Electricity Supply Department. Erection of a steel-frame turbine house. (February 19th.)

Preston.—March 12th. Electricity Department. 4,200 yd. (approx.) e.h.p. cable and four sets of e.h.p., 3-phase transformers. (See this issue.)

Rochdale.—March 16th. Gas and Electricity Committee. One 1,250-kW (or alternatively 1,500-kW) rotary-converter equipment, including transformer and switchgear. (See this issue.)

Town Council. Electric lighting and power installation, 34 houses, Clarke's Lane housing estate. Particulars from borough surveyor.

South Africa.—JOHANNESBURG.—April 12th. S.A. Railways and Harbours. Electrification of Cape Town Suburban Railway. Supply and erection of the overhead equipment of the permanent way and overhead transmission and distribution lines. (February 12th.)

CAPE TOWN.—March 17th. Electricity Department. Electric cables, electric light poles, cross arms, insulators, &c.

MOOREESBURG.—March 20th. Municipal Council. Engine-room equipment, including oil engines and tanks, main generators, motor booster, pumps and air compressor, travelling crane, switchboard, battery and connections, distribution system, instruments, meters, &c.; and house service connections.*

Tynemouth.—March 15th. Electricity Department. One 250-kVA transformer. (See this issue.)

Warrington.—March 15th. Electricity and Tramways Committee. Motors and transformers. (See this issue.)

*Further particulars can be obtained at the Department of Overseas Trade (Inquiry Room), 35, Old Queen Street, S.W.1.

Closed.

Billericay.—Board of Guardians. Accepted:—
Installing electric lighting at the new infirmary buildings (£682).—Ellis and Ward.

Calne.—Town Council. Accepted:—
Switchboard (£176).—Crompton & Co., Ltd.

Deal.—War Memorial Hospital Committee. Accepted:—
Installation of a wireless set (£131), including a steel mast and spare h.p. batteries.—C. O. Clark.

Egypt.—Egyptian Ministry of the Interior. Accepted:—
H.p. underground and l.p. overhead distribution system (£9,886), for the municipality of Zifta; one 240-kVA and two 120-kVA alternators, with h.p. and l.p. switchgear, &c. (£5,307), for the municipality of Minieh; and one 25-kVA alternator, with Willans Diesel engine; one 160-kVA rotary-converter, with h.p. and l.p. switchgear, &c. (£7,101).—British Thomson-Houston & Co., Ltd.

Edmonton.—
Electrical work at the Education Offices.—Ridout & Ratcliff, Ltd.

Glasgow.—Tramways Committee. Accepted:—
Trolley feeder cable.—Siemens Bros. & Co., Ltd.
Lead-covered cable.—Standard Telephones & Cables, Ltd.
Dust exhaust plant.—James Keith & Blackman & Co., Ltd.

Water Committee. Accepted:—
Electric lighting fittings, &c., at Glengyll House (£353).—Allan Arthur and Ure.

Health Committee. Recommended:—
Electric lighting work at Bellefield Sanatorium (£1,215).—Haddow & Co.

Electricity Committee. Recommended:—
1,500-kW rotary-converter (£5,622).—British Thomson-Houston Co., Ltd.

Government Contracts.—The undermentioned Government contracts were placed during January, 1926:—

ADMIRALTY CONTRACT AND PURCHASE DEPARTMENT.

Accumulators.—Chloride Electrical Storage Co., Ltd.
Turbo-alternators.—C. A. Parsons & Co., Ltd.
Batteries.—Premier Accumulator Co., Ltd.
Cells and accumulators.—London Battery & Cable Co., Ltd.
Cells.—Fuller's United Electric Works, Ltd.; Edison Swan Electric Co., Ltd.
Air compressors.—P. Brotherhood, Ltd.
Electrically-driven compressors.—Belliss & Morcom, Ltd.
Electrodes.—Alloy Welding Processes, Ltd.
Electric lamps.—British Thomson-Houston Co., Ltd.; Edison Swan Electric Co., Ltd.; General Electric Co., Ltd.; Metro-Vick Supplies, Ltd.; Siemens & English Electric Lamp Co., Ltd.
Overhead electric traveller.—T. Smith & Sons (Rodley), Ltd.

WAR OFFICE.

Aluminium ingot.—British Aluminium Co., Ltd.
Generating sets.—W. H. Dorman & Co., Ltd.
Switchgear and switchboard.—Johnson & Phillips, Ltd.
Transformers.—Newton Bros., Ltd.
W./t. valves.—Edison Swan Electric Co., Ltd.

AIR MINISTRY.

Alternators and switch panels (Kidbrooke).—Electric Construction Co., Ltd.
Conversion of single-phase supply (Cardington).—G. E. Taylor & Co.
Engines and generators (North Weald and Upper Heyford.)—Blackstone and Co.
Generating sets (Waddington).—W. H. Allen, Sons & Co.
Internal wiring (Heyford).—Lea, Son & Co., Ltd.
Oil-engine generating sets (Karachi).—Babcock & Wilcox, Ltd.
Control resistance and voltmeter.—Pyne Mfg. Co., Ltd.
Electric cable.—W. T. Henley's Telegraph Works Co., Ltd.
Generators and spares.—Mortley, Sprague & Co., Ltd.; Small Electric Motors, Ltd.
Repair of transmitters.—Gambrell Bros., Ltd.
W./t. valves.—Edison Swan Electric Co., Ltd.

POST OFFICE.

Telephone apparatus.—Automatic Telephone Mfg. Co., Ltd.; British L. M. Ericsson Mfg. Co., Ltd.; General Electric Co., Ltd.; Phœnix Telephone & Electric Works, Ltd.; Siemens Bros. & Co., Ltd.; Standard Telephones & Cables, Ltd.; Telegraph Condenser Co., Ltd.
Testing protective apparatus.—British L. M. Ericsson Mfg. Co., Ltd.; Phœnix Telephone & Electric Works, Ltd.; Reliable Engineering Co., Ltd.
Battery stores.—Alton Battery Co., Ltd.; D. P. Battery Co., Ltd.
Cable (various).—British Insulated Cables, Ltd.; Connollys (Blackley), Ltd.; Enfield Cable Works, Ltd.; W. T. Glover & Co., Ltd.; Hackbridge Cable Co., Ltd.; W. T. Henley's Telegraph Works Co., Ltd.; Johnson & Phillips, Ltd.; Pirelli-General Cable Works, Ltd.; Siemens Bros. & Co., Ltd.; Standard Telephones & Cables, Ltd.; Union Cable Co., Ltd.
Telephone cords.—British Insulated Cables, Ltd.; London Electric Wire Co. & Smiths, Ltd.; Standard Telephones & Cables, Ltd.
Lamps.—A. C. Cossor, Ltd.
Tumbler switches.—J. A. Crabtree & Co., Ltd.
Earth plates, rod stays, stay swivels.—Bullers, Ltd.
Enamelled wire.—London Electric Wire Co., Ltd.
Batteries (Manchester telephone trunk exchange).—Alton Wire Co., Ltd
Manufacture, supply, drawing-in and jointing cable.—Sheffield-Rotherham: British Insulated Cables, Ltd. Leicester (Rothley)-Loughborough: Siemens Bros., & Co., Ltd.
Manufacture, supply, drawing-in, &c., cable and installing loading coil cases.—London-Canterbury: Standard Telephones & Cables, Ltd.
Electric lift (Manchester, superintending engineer's office).—J. Bennie, Ltd.
Telephone exchange equipment.—Marton, Wimbledon, Southall, Waterloo: Automatic Telephone Mfg. Co., Ltd. Douglas (Glasgow), Birmingham (Midland), Jesmond (Newcastle-on-Tyne), Paddington: Standard Telephones & Cables, Ltd. Western (London): Siemens Bros. & Co., Ltd. Sub-contractors: Hart Accumulator Co., Ltd., for batteries; Newton Bros. (Derby), Ltd., for machines. Wakefield: Siemens Bros. & Co., Ltd. Sub-contractors: Chloride Electrical Storage Co., Ltd., for batteries; English Electric Co., Ltd., for charging machines; Crompton & Co., Ltd., for ringing machines. Sandal (Wakefield), Grimsby, Letchworth: Siemens Bros. & Co., Ltd. Keighley: General Electric Co., Ltd. Sub-contractors: Chloride Electrical Storage Co., Ltd., for batteries; Crompton & Co., Ltd., for machines. Mansfield: General Electric Co., Ltd. Newcastle-on-Tyne (Central): British L. M. Ericsson Mfg. Co., Ltd. Sub-contractors for batteries: Tudor Accumulator Co., Ltd.; for ringing machines: Crompton and Co., Ltd.
Private branch exchange telephone equipment.—Birmingham Chamber of Commerce; A. W. Bain & Sons (Leeds); Kendal, Milne & Co. (Harrods), Ltd., Manchester. Bristol Docks Committee: Stewart, Thompson & Co., Ltd. (Manchester); Blake & Co., Ltd. (Liverpool). Lambeth Borough Council; Bradford (Yorks.) Royal Infirmary; Eastbourne Corporation: Relay Automatic Telephone Co., Ltd.
Telephone repeater station (voltage control board).—Fenny Stratford; Newton Bros. (Derby), Ltd.

H.M. OFFICE OF WORKS.

Wiring Ministry of Pensions Hospital, Leeds.—A. Innes.
Wiring Montague House, S.W.—R. Langston-Jones & Co.

CROWN AGENTS FOR THE COLONIES.

Electric cable, &c.—W. T. Henley's Telegraph Works Co., Ltd.
Diesel engine and generator.—English Electric Co., Ltd.
Electric equipment.—J. Stone & Co., Ltd.
Flood alarm cabinets, &c.—General Electric Co., Ltd.
Insulated cables.—St. Helens Cable & Rubber Co., Ltd.
Train-lighting cells.—D. P. Battery Co., Ltd.
Telegraph instruments, &c.—Walter's Electrical Mfg. Co., Ltd.
Telegraph ironwork, &c.—Bullers, Ltd.
Telephone exchanges.—Peel-Conner Telephone Works.
Telephones and switchboards.—Standard Telephones & Cables, Ltd.
Copper wire, &c.—F. Smith & Co.; Shropshire Iron Co., Ltd.
Stannos wire, &c.—Siemens Bros. & Co., Ltd.

Irish Free State.—DUBLIN.—The following contracts were placed by the Commissioners of Public Works during the month of January:—

Installation of electric lighting at Irish Land Commission offices, Upper Merrion Street, Dublin.—Handley & Robinson, Ltd.
Installation of electric lighting at Munster Institute, Cork.—Brooks, Thomás & Co., Ltd.—*Irish Builder and Engineer.*

Lamp Contracts.—The Southern Railway has placed contracts for six months for the supply of electric lamps with the British Thomson-Houston Co., Ltd., the Siemens and English Electric Lamp Co., Ltd., and the Edison Swan Electric Co., Ltd.

Letchworth.—

Electrical work for the new abattoir.—Ridout & Ratcliff, Ltd.

London. — ISLINGTON. — Electricity Committee. Recommended:—

Commutator and motor (£75).—John Phillips & Co.

South Africa.—According to the *Evening News*, a contract for a 10,000-h.p. motor-driven winder for a gold mine in South Africa has been placed with Messrs. Fullerton, Hodgart and Barclay, Ltd.

Sowerby Bridge.—Urban District Council. Accepted:—

Electrician's work in connection with the erection of a further 25 houses, Willow Street site.—Oakley, Green & Wilson, Halifax.

Walthamstow.—Urban Council. Accepted:—

Boiler-house plant for the electricity works (between £17,000 and £18,000).—Babcock & Wilcox, Ltd.
Economiser (£3,800).—E. Green & Son.

Willesden.—Electricity Committee. Recommended:—

H.p. cable for 12 months.—British Insulated Cables, Ltd.
L.p. cables for 12 months.—Pirelli-General Cables, Ltd.

The "Electrical Review" Service Department.

INQUIRIES must be accompanied by a stamped addressed envelope.

We should be glad to learn the names and addresses of makers of the following:—

DUOLITE lamps.
EXPRESS electric urns.
DAINTY vacuum cleaners.

Forthcoming Events.

Physical Society of London.—Friday, February 26th. At the Imperial College of Science, South Kensington, S.W. At 5 p.m. Ordinary Scientific Meeting.

Institution of Production Engineers.—Friday, February 26th. At 83, Pall Mall, S.W. Debate on "Payment by Results," to be opened by Mr. R. H. Hutchinson.

Birmingham Electric Club.—Friday, February 26th. At the Grand Hotel, Colmore Row, Birmingham. At 7 p.m. Discussion on "Power Factor," to be opened by Messrs. F. R. Unwin and F. C. Hall.

Institute of Transport.—Monday, March 1st. At the Institution of Electrical Engineers, Victoria Embankment, W.C. At 5.30 p.m. Paper on "State-ownership of Waterways," by Mr. H. D. Dickinson.

Glasgow Corporation Electricity Department Engineering Society.—Monday, March 1st. At the Welfare Hall, St. Andrew's Cross Works. At 7.45 p.m. Papers on "The Varying Length of Night with Latitude," by Mr. H. J. McEwen; on "Design and Detail," by Mr. J. Elliott; and on "Section Pillars and Mains Fittings," by Mr. A. Rutledge.

Society of Engineers.—Monday, March 1st. At Burlington House, W. At 5.30 p.m. Paper on "Tidal Power on the River Severn—Some Notes and Suggestions on its Utilisation," by Mr. W. M. Beckett.

Roentgen Society.—Tuesday, March 2nd. At 32, Welbeck Street, W. At 8.15 p.m. Ordinary meeting.

National Association of Supervising Electricians.—Tuesday, March 2nd. At the Junior Institution of Engineers, 39, Victoria Street, S.W. At 7.15 p.m. Paper on "Electricity Supply," by Mr. A. Kirk.

Ideal Home Exhibition.—At Olympia, W. From March 2nd to 27th.

Electrical Society of Glasgow.—Tuesday, March 2nd. At Glasgow. Paper on "Industrial Heating Appliances," by Mr. P. J. Sims.

Royal Society of Arts.—Wednesday, March 3rd. At John Street, Adelphi, W.C. At 8 p.m. Lecture on "Science in the Cable Industry," by Mr. P. Dunsheath.

Monday, March 1st. At 8 p.m. Cantor Lecture on "The Production and Measurement of High Vacua," by Dr. G. W. C. Kaye. (Lecture III.)

Institution of Heating and Ventilating Engineers.—Wednesday, March 3rd. At Caxton Hall, Westminster, S.W. At 7 p.m. Paper on "The Design and Application of Electric Motors Relating to Heating and Ventilating Installations," by Mr. J. Meech.

Edinburgh Electrical Society.—Wednesday, March 3rd. At the Royal Society of Art, 117, George Street. At 8 p.m. Paper on "Hydro-Electric Plant," by Mr. A. Arthur.

Institution of Electrical Engineers.—Thursday, March 4th. At the Institution, Victoria Embankment, W.C. At 5 p.m. Paper on "Electro-Farming, or the Application of Electricity to Agriculture," by Mr. R. B. Matthews.

(Wireless Section).—Wednesday, March 3rd. At the Institution, Victoria Embankment, W.C. At 6 p.m. Papers on "The Directional Recording of Atmospherics," by Mr. R. A. Watson Watt; and on "An Instantaneous Direct Reading Radiogoniometer," by Mr. R. A. Watson Watt and Mr. J. F. Herd.

(North-Western Centre).—Tuesday, March 2nd. At the Engineers' Club, Manchester. At 7 p.m. Paper, "Notes on the Testing of Static Transformers," by Mr. J. L. Thompson and Mr. H. Walmsley.

(Western Centre).—Monday, March 1st. At the South Wales Institute of Engineers, Cardiff. At 6 p.m. Lecture on "The Engineer: His Due and His Duty in Life," by Mr. T. Carter.

(East-Midland Sub-Centre).—Tuesday, March 2nd. At the Technical College, Derby. At 6.45 p.m. Paper on "Steam Pipes for Extra-High-Pressures and Temperatures," by J. A. Alton.

(Sheffield Sub-Centre).—Wednesday, March 3rd. At the Royal Victoria Hotel, Sheffield. At 7.45 p.m. Ordinary general meeting and smoking concert. Address by the president, Mr. R. A. Chattock.

Royal Institution.—Thursday, March 4th. At 21, Albemarle Street, W. At 5.15 p.m. Lecture on "The Atom of Light and the Atom of Electricity," by Dr. C. D. Ellis.

Electrical Power Engineers' Association (Southern Division).—Friday, March 5th. At the Institution of Electrical Engineers, Victoria Embankment, W.C.2. At 7 p.m. Lecture on "A 50,000-kW Parsons Reaction Turbine," by Mr. C. D. Gibb.

Junior Institution of Engineers.—Friday, March 5th. At the Engineers' Club, Waterloo Street, Birmingham. At 7.30 p.m. Paper on "Hoisting Appliances," by Mr. C. H. Woodfield.

Friday, March 5th. At 39, Victoria Street, S.W. At 7.30 p.m. Paper, "Tendencies in Modern Electric Practice," by Mr. J. M. Seddon.

(North-Western Section).—Monday, March 1st. Paper on the "Behaviour of Metals Under Stress," by Mr. W. E. W. Millington.

Joint Delegation Dinner.—Friday, March 5th. At the Great Northern Hotel, Leeds. At 6.30 p.m. Dinner of the Joint Delegation of the Local (Yorkshire) Associations of the Engineering Institutions.

Association of Mining Electrical Engineers (Western District Sub-Branch).—Saturday, March 6th. At 62, Wind Street, Swansea. Discussion on "D.c. *versus* A.c. for Colliery Practice," to be opened by Messrs. G. W. Walton and H. Thomas.

Notes.

The Optical Convention, 1926.—We have received a copy of the particulars of the above Convention which is to be held at the Imperial College of Science and Technology, South Kensington, from April 12th to 17th inclusive. The programme of the Convention is set out and the privileges and subscriptions of membership are also given.

Decimal Coinage.—In accordance with the decision of the Grand Council of the Federation of British Industries, a letter was sent to the Treasury asking for an inquiry into the scheme suggested by Mr. Harry Allcock for decimalising the shilling. As a reply was received to the effect that in the view of the Treasury the new suggestion did not differ in any material particular from the scheme propounded by Lord Southwark and rejected by the majority of the Royal Commission in 1920, a further letter was submitted pointing out the ways in which the new suggestions differed from that scheme. The Treasury, however, again gave an unfavourable reply.

E.P.E.A. Dinner.—The North of Ireland Section of the Electrical Power Engineers' Association held its third annual dinner in Thompson's Restaurant, Belfast, on February 14th, when Mr. R. P. Watson (chairman) presided. The guests included the High Sheriff (Alderman Oswald Jamison), Councillor Major Hall-Thompson, Mr. J. F. Gordon, M.P., Mr. A. S. Ostler (president of the Association), and others. Mr. J. F. Gordon, in proposing "The Electrical Power Engineers' Association," said repeated statements had been made that some measures must be taken to reduce the disparity between the amount of electricity consumed for industrial, commercial, and domestic purposes by the people of Northern Ireland and their competitors in the world markets. The consumption per head of population in Great Britain was 200, Tasmania 500, Canada 900, and in some areas in the United States over 1,000 kWh. In Northern Ireland the average figure was 50.3 kWh, and there was considerable scope for further development. With the remarkable improvements which had been made in the last ten years in the generating practice in coal-fired stations, very little margin of benefit was left to the hydro-electric station, although in an undertaking of the latter type there were no recurring fuel costs. The Commission on the Development of the Natural and Industrial Resources had under examination the possibility of utilising in a comprehensive scheme the existing and potential sources of supply such as at Belfast, Londonderry, Coalisland, Lower Bann (Carnroe), and Strangford Lough, and thereby turning the natural resources into material benefits. It had been suggested that the electricity requirements of what might be termed the industrial area of Northern Ireland could be adequately met by the erection of a ring main system embracing the more important and densely populated towns circling Lough Neagh, with possible extensions at a later date to include the other important urban centres in Northern Ireland.

Local Society.—The second lecture of the session of the Sheffield Illumination Society was delivered by Mr. W. T. Wardale, on February 18th, on "How Electricity is Supplied to the Tramcars." The lecturer dealt with the generation and transmission of energy for tramway purposes.

Appointments Vacant.—Telegraph foremen (£400), for the Government of the Gold Coast. Switchboard attendant for Epsom U.D.C. Electric Light Department. Car shed superintendent (£338) for the Rawtenstall Corporation Electricity Department. Shift charge engineer, for the Kirkcaldy Corporation Electricity Works. Clerk of works, for the Borough of Newark Electricity Department. Junior assistant to the borough electrical engineer, for the Corporation of Ealing Electricity Department. (See our advertisement pages to-day.)

The Electrical Trades Benevolent Institution.—It is interesting to learn that Henley's Dramatic Club has promised to give in aid of the Institution a performance of the play "If Four Walls Told"—a village tale in three acts, by Edward Percy—at King George's Hall, Caroline Street, London, on Thursday, March 4th, at 8 p.m. Tickets, at prices from 10s. 6d. to 3s., all numbered and reserved, can be obtained from the assistant hon. secretary, Mr. E. J. King, at 98, Grosvenor Road, S.W.1. The well-known ability of the members of the club, and the desire to help the E.T.B.I., ought to ensure a full house.

London Traffic. — Lecturing on "Traffic Reform" on Sunday last, Sir Henry Maybury, chairman of the London Traffic Advisory Committee, said that the remedy for the traffic congestion was co-ordination—the pooling of resources and receipts, the elimination of waste, extension of tubes, and the electrification of the suburban railways. He looked forward to the early production of a scheme embodying all those features. Referring to the increased patronage of the omnibuses, at the expense of other forms of transport, Sir Henry said his Committee was unanimous in holding the opinion that tramways were essential to the movement of people in London.

Explosives in Coal Mines.—The Secretary for Mines announces that he has issued an Order, in pursuance of Section 61 of the Coal Mines Act, 1911, varying the list of "permitted explosives" used in certain classes of coal mines. Certain definitions of explosives have been amended, and others have been removed from the "permitted list." The Order may be purchased from H.M. Stationery Office, price 2d.

Very High-pressure Turbines.—It is reported that two large turbines, each 79 ft. long and weighing over 400 tons, working with steam at 600 lb. per sq. in., which is claimed to be the highest steam pressure now in commercial use in the United States, were recently put into commission at the new steam station of the Columbia Gas and Electric Company at Columbia Park, Ohio, at a cost of $20,000,000. The machines are of the tandem type, and are each rated at 45,000 kW. The steam is reheated to its original temperature, 725 deg. F., between the high and low-pressure sections. Fourteen stages accommodate the high-pressure and 12 the low-pressure sections. Steam is bled from the turbines, after partial expansion, for feed-water heating. The estimated daily coal consumption of the two machines is about 1,000 tons, and, for each ton of coal, from 400 to 450 tons of water. Provision is made in the station for eight turbines.

The Electrode Capacity and Resistance of Electrolytes.—It has long been known that a capacity effect exists at the surface of an electrode placed in an electrolytic solution, and it is in consequence of this effect that, when measuring the resistance of such a solution by means of a Wheatstone bridge, with a telephone as indicator, one never obtains complete silence. Wien showed, in 1896, that, in addition to a capacity effect, there is also an extra resistance effect introduced by the electrodes. Various attempts have been made to arrive at the law connecting this extra resistance with the frequency of the current employed to measure it, but conflicting results have been obtained. The work described by Mr. B. B. Baneiji in his recent Faraday Society paper, entitled "The Electrode Capacity and Resistance of Electrolytes for a Wide Range of Frequencies," was undertaken with a view to clearing up the uncertainty that obtains, and a number of electrolytes have been examined to find the variation of polarisation capacity and resistance over a wide range of frequencies. The simplest combination of resistance and condenser behaves, unless one of them is either too high or too low, as a condenser whose capacity is a function of the frequency. In the case of an electrolytic cell, there is the further complication that the resistance is composed primarily of the electrolytic resistance, and secondarily of the electrode values, while the capacity effect is a purely electrode effect. Consequently, more was likely to be learnt if attention was directed towards the capacity of the cells, and that was the basis of the present work.

The method employed was that of the Wheatstone bridge for alternating current, the source of current being a triode valve generator. Reference must be made to the paper for full particulars of the experimental arrangements. The electrodes used were silver in silver nitrate, cadmium in cadmium sulphate, and nickel in nickel sulphate. The results show that over a wide range of frequencies up to 2,500 per second, the capacity may be represented by a hyperbola when plotted against the square of the frequencies. The inference is made that the phenomena at the electrodes may be very closely represented as due to two condensers, one of them leaking very heavily and the other only slightly. The interpretation of this hypothesis is based on the existence of the Helmholtz double layer, which would necessarily be accompanied by a capacity effect. If, further, the space between the layers be supposed large enough to enable a few charged particles to move at random between them, the case will be that of a leaky condenser, analogous to what would happen if two plates were placed in a gas containing a few ionised particles. This explains the presence of one leaky condenser. The other may be expected as a result of transport phenomena. When a small current passes through an electrolytic cell, there will be a change of concentration tending to establish an e.m.f. opposing the current proportional to the change in concentration, which change will itself be proportional to the quantity of electricity that has entered the cell. The effect will therefore be similar to that produced by a capacity, and diffusion will produce an effect similar to a small leak. From the values of the capacities measured, the thickness of the double layer can be calculated, and it is found to be consistent with the value found by other methods.

Improved Lighting Scheme.—As the result of a recent lighting scheme of the St. Marylebone Electricity Department, the illumination of Baker Street and Orchard Street has been greatly improved. Wembley lanterns, manufactured by the General Electric Co., Ltd., fitted with 750-W gasfilled lamps, have been adopted throughout the scheme and the accompanying illustration shows the double-fitting unit outside the Metropolitan Railway station. The body of the lantern is constructed of heavy-gauge sheet copper, and is suitably ventilated. A special protected focusing device enables the lamp to be adjusted inside the prismatic refractor and varied to give any required light distribution; adjustments can be made from the outside with extreme accuracy. The lantern has been subjected to many stringent tests, and fully complies, it is claimed, with all the indispensable requirements for a street lighting unit.

Wembley Lanterns in Baker Street.

Mines Report. — We have received a copy of the preliminary statement of the number of deaths caused by accidents in and about the mines and quarries of Great Britain during 1925. In all there were 1,140 separate fatal accidents, which resulted in 1,228 deaths, against 1,294 deaths for the previous year, when there were 1,224 fatal accidents. Of the total deaths 1,129 occurred at mines under the Coal Mines Act, and eight of these are attributed to the use of electricity, three under and five above ground. The number of deaths reported at mines under the Metalliferous Mines Regulation is shown as 23, and that reported at quarries, more than 20 ft. deep, under the Quarries Act, is recorded as 76. No deaths are attributed to the use of electricity under the last two sections. In addition, eight deaths at quarries 20 ft. or less deep were reported.

Research at Birmingham.—The Joint Standing Committee for Research, at the University of Birmingham, in the annual report just issued, states that in the Department of Electrical Engineering research work has been carried out on the conduction of currents by electrolytes; the testing of alternating-current machines by means of direct current; the behaviour of litho stone, and other semi-conductors; and the transmission of power at high frequencies.

Tramways and Light Railways Association.—ANNUAL CONGRESS.—As most of the available hotel accommodation at Bristol and Bath has already been bespoken by two other public bodies for the week selected by the Association and the week following, the Council has decided, after consideration, to hold the Congress at Torquay on June 24th and 25th instead of at Bristol.

Low-Temperature Carbonisation.—In a paper read by Mr. David Brownlie, B.Sc., before the Institution of Mining Engineers, he expressed the opinion that the next stage of evolution in steam power-station operation would be the combination of the low-temperature carbonisation of raw coal with the separation of the tar or crude oils and, if necessary, ammonia, and the combustion under the steam boilers of the residual gas, along with the smokeless low-temperature fuel, either in a pulverised condition or in the solid form, using travelling-grate stokers. He stated that it was impossible to go on burning 8,000,000 tons of raw coal per annum in the power stations of Great Britain. If carbonisation as part of the boiler plant operation was adopted, it would give every year about 20,000,000 gallons of motor spirit, 120,000,000 gallons of low-temperature tar, and 53,000 tons of sulphate of ammonia, while requiring 9,600,000 tons of coal instead of 8,000,000 tons for the same steam output. Many super-power stations to-day were burning 1,000 tons of raw coal per 24 hours, and it was not much of a step to carbonise this coal, which already had to be crushed, conveyed, and stored in overhead bunkers. The same remarks applied to other large furnaces, such as those used in the iron and steel, ceramic, glass and chemical industries. He urged the colliery industry in Great Britain to co-operate and study on scientific and practical lines the whole subject of low-temperature carbonisation; over 100 processes were available, and in many cases smokeless fuel and by-products could be sold to much better advantage than raw coal, while low-grade refuse fuels also were available for utilisation.

North Wales Dam Disaster.—The Government, in furtherance of its decision, as announced in the House of Commons on December 21st last, to make further investigations of a technical character into the design and construction both of the Dolgarrog dam which failed, and the other local dams under the control of the Aluminium Corporation and the North Wales Power Co., has, according to the *Financial News*, appointed the firm of Sir Alexander Gibb & Partners, chartered and consulting civil engineers, of Westminster, to hold a full investigation and report thereon.

Ships' Wireless.—The m.v. *Asturias*, which displaces 35,390 tons and was built at Belfast for the Royal Mail Steam Packet Co., is to sail from Southampton to-day (February 26th) on her maiden voyage to South America. She has been equipped by the Marconi International Marine Communication Co., Ltd., with a very complete wireless installation. The main telegraph installation consists of a 1½-kW quenched-spark transmitter, with emergency apparatus, and also a long-range valve transmitter. The receiving equipment consists of the standard long-range receiver embodying a four-electrode valve amplifier, with the addition of an extra-high-frequency amplifier, which makes the tuning extremely sensitive and very selective. Direction-finding equipment is carried as an aid to navigation. The aerials of this installation are mounted in an open teak framework 8½ ft. in height fixed rigidly to the deck, which method dispenses with the large aerial system hitherto employed. In addition, two of the lifeboats also carry Marconi ¼-kW transmitters of the quenched-spark type, the power supply being obtained from petrol-driven generators. Valve receivers, which also incorporate alternative crystal reception, are used in the lifeboats. A Marconi band repeater has been installed in the *Asturias*, and six loud-speakers can be used in any of a dozen selected places in various parts of the vessel in order that music played by either the ship's orchestra, reproduced from a gramophone, or received by wireless, may be reproduced in any part of the vessel. The apparatus includes an amplifier, a generator with the necessary controlling apparatus, a control unit to change from microphone to gramophone, and a gramophone without sound box and horn. The amplifier station also includes a small loud-speaker to act as a pilot to the operator, thus keeping him informed as to what is going on at the various reproducing positions. The introduction of a small motor generator has made it unnecessary to include accumulator batteries with their attendant maintenance difficulties. The generator is driven by power from the ship's electric mains, and supplies the energy required both for the filament and anodes of the valves in the amplifier. In reproducing gramophone music, the scratching of the needle has been eliminated by the replacement of the sound box by an electrical device of the Marconi Co., by which the indentations of the gramophone record are converted directly into a varying electric current, which is amplified and passed on to the loud-speaker. In this way distortionless reproduction of the original music, or speech, on the gramophone record is claimed to be obtained, and the volume of music produced can be controlled through wide limits.

A Smoke Washer.—Organised by the Smoke Abolition Co., of Manchester, a demonstration of a smoke-washing device, capable of adaptation to works chimneys, &c., was given at Manchester on February 9th. Mr. H. M. Sidebottom, the inventor, conducted smoke from a boiler to a box enclosing a wheel that is bladed on the circumference. Water was played on to the blades, causing the wheel to revolve and the water to be sprayed in the smoke stream. The effect of this is to "increase the draught" and to facilitate the passage of the washed smoke. The discharged water laden with dirt from the smoke is filtered and the residue reclaimed. We are informed that the residuum can be put back on the fire and burned, thus extracting its latent potentiality of heat. It was explained that what otherwise would be waste contains valuable by-products.

Accumulator Manufacturers' Association.—The annual dinner of the Association was held at the Connaught Rooms, London, on Monday last, and was a very successful function. Our report will appear next week.

Gallium-in-Quartz High-temperature Thermometer.—A thermometer similar in appearance to the usual mercury-in-glass one, but capable of registering a temperature of more than 1,800 deg. F., has been developed in the Thomson Research Laboratory of the General Electric Co., of America, at Lynn, Mass., U.S.A. Instead of glass, which would melt at far lower temperatures, the thermometer bulb and stem are made of clear, fused quartz; and instead of mercury, which would boil and cause the thermometer to explode at such a temperature, gallium, one of the rarer metals, is used. A temperature of 1,000 deg. F. is the maximum with the mercury-in-glass thermometer, and such thermometers are inaccurate at high temperatures. By the use of mercury-in-quartz, German scientists attained a previously maximum temperature of about 1,300 deg. F.

The development of a method for the commercial production of clear fused quartz as tubing was the first development in the Thomson research laboratory that made the new instruments possible. Gallium is similar to mercury in appearance, but is much lighter in weight. It melts at a temperature of 100 deg. F., but can be cooled to about 40 deg. before solidifying. Gallium boils at about 3,600 deg., so that it is not necessary to have it under pressure in the thermometer.

Motor Vehicle Parade.—The 20th annual London parade of commercial motor vehicles, organised by the Commercial Motor Users' Association (Incorporated), will take place in Lincoln's Inn Fields, on March 27th, under the patronage of His Majesty the King. The British Electrical Development Association (Inc.) is co-operating with the C.M.U.A. in connection with the electric-vehicle class of the parade, and special prizes will be awarded to the drivers of the winning vehicles in this class.

London's Postal Tube.—An account of the expenditure in respect of the London Post Office Tube railway has been issued as a White Paper. It is shown that the total expended to March 31st last was £1,100,000, which is the full amount authorised. The heaviest item is tunnelling cost, which aggregates £780,007, while permanent way, &c., involves £165,381. Preliminary expenses and professional fees are returned at £44,512.

Institution Notes.

Institution of Electrical Engineers.—The semi-jubilee of the Scottish Centre of the Institution of Electrical Engineers was celebrated on February 17th, when about 300 members and friends met in the Grosvenor Restaurant, Gordon Street, Glasgow. The function took the form of a dinner, whist drive, and dance, and Prof. Magnus MacLean, D.Sc., chairman of the Centre, presided. Representatives from all branches of the electrical industry in the West of Scotland were present. Music by Mr. J. Meredith Kay's Orchestra added to the pleasure of the evening, and the Committee responsible was congratulated on the successful way in which the arrangements were carried through.

Institution of Fuel Economy Engineers.—The second Council meeting of the Institution of Fuel Economy Engineers was held in London on Friday, February 12th, when four additional members were elected to the Council, making the total now 16. Thirteen new members were elected. It was decided that for associate members the annual subscription would be £2 2s., and for students £1 1s. It was also decided that preferential terms should be given to full members who are full members of other leading institutions, which reduces the fee in such cases from £3 3s. to £2 2s. Amongst the members of Council are Messrs. John Bruce, A.M.I.E.E., A. W. A. Chivers, M.Inst.T., L. M. Jockel, A.M.I.E.E., E. W. L. Nicol, A.M.I.E.E., A. Hugh Seabrook, M.I.E.E., W. Alderson Smith, F.C.I.S., Charles P. Sparks, C.B.E., M.I.E.E., John D. Troup, M.I.Mech.E., and Prof. R. V. Wheeler, D.Sc. The scope of the Institution covers every phase of fuel technology; its main objects are: To promote the science and practice of fuel economy engineering in all its branches, and to facilitate the interchange of ideas respecting improvements in the various branches of fuel technology. The next Council meeting will be held in London on March 19th, and the temporary office is at 29, Sherwin Road, Lenton, Nottingham (Mr. H. L. Pirie, secretary).

Diesel Engine Users' Association.—At the February meeting of the Association Mr. Geoffrey Porter read a paper on "Heavy-Oil Engine Installations; Choice of Site and Lay-out of Plant," pointing out that importance had to be attached to the avoidance of vibration, and in this connection the most favourable type of sub-soil was one that was dry and consisted of closely compacted particles capable of small relative movement. In deciding upon the number and individual capacity of generating sets for a given total capacity, the primary consideration to be borne in mind was the running plant load factor; the range of capacity should be such that no engine would be required under normal circumstances to operate at light loads, a light load being estimated as one below 50 per cent. of the maximum continuous rating of the engine.

Our Personal Column.

(Electrical men are invited to enable us to keep readers of the "Electrical Review" posted concerning their movements).

On February 13th, the staff of the Grimsby Corporation Electricity Works gave a complimentary dinner to Lieut.-Col. W. A. VIGNOLES, D.S.O., at the Oberon Hotel, to celebrate the 25th anniversary of the starting of supply on February 13th, 1901. Mr. Vignoles was engineer-in-charge of the erection of the plant at that date and he was placed in charge of the undertaking in the following April. Mr. A. S. Channon presided. Mr. Vignoles was presented with a gentleman's wardrob and Mrs. Vignoles with a combined silver cake-dish and casserole. About 80 sat down to dinner, the only guests in the number being Councillors W. H. Thickett and W. E. Fletcher (chairman and vice-chairman of the Electricity Committee). An appropriate and humorous menu had been prepared by Mr. S. S. Russell, a member of the staff. Mr. Channon, in making the presentation, said that Mr. Vignoles was a gentleman

Lt.-Col. W. A. Vignoles, D.S.O.
Borough Electrical Engineer of Grimsby.

in every sense of the word and that the undertaking had been successful largely because of the manner in which he had conducted its affairs. Mr. Vignoles, in responding, referred to the loyalty of the staff and the excellent way in which they all pulled together. Mr. J. Magee proposed the toast of the Chairman and Vice-Chairman of the Corporation Electricity Committee, and both gentlemen replied.

Mr. F. R. GIBSON, station superintendent to the Portsmouth Corporation tramways, who is shortly retiring under the superannuation scheme after a service of 25 years, was last week presented by the staff of the Engineer's Department with a barometer, cigars and an illuminated address, and an umbrella for Mrs. Gibson. Mr. Lironi, the chief engineer, made the presentation in the power station engine room.

The Exeter Electricity Committee has recommended the City Council to increase the salary of Mr. MUNRO, the electrical engineer, to £790, which is the recognised minimum.

Mr. R. S. J. NEVE has been appointed to succeed Mr. C. Batt as superintendent of Post Office Telegraphs at Bournemouth. He has been in the telegraph service for 41 years.

Of 23 applicants for the post of tramway manager at Portsmouth, at a commencing salary of £1,000 a year, Mr. BEN HALL, tramway manager of Halifax, is recommended for appointment by the Town Council.

Mr. A. GOODWIN, of Messrs. C. A. Vandervell & Co., Ltd., is taking a prolonged rest from business, which it is hoped will completely restore him to health.

A presentation is to be made to-day, Friday (4 p.m.), at the Institution of Electrical Engineers to Mr. HARRY BOOTH, O.B.E., on behalf of his many friends in all branches of the electricity supply industry. Sir Harry Renwick is to make the presentation and speeches will be made by representative leaders of the industry.

Obituary.—MR. A. E. GIFFEN.—The death is announced, at the age of 55 years, of Mr. Alexander Ewing Giffen, A.M.I.E.E., of Stoke-on-Trent, who was for a number of years sectional engineer for the Post Office Telephones and Telegraphs in the Hanley Section. He had been associated with the P.O. Engineering Department since 1897.

MR. H. B. HORNE.—The death took place on February 7th, of Mr. Henry Balfour Horne, chief draughtsman to the Yorkshire Electric Power Co., Ltd. He had been with the company for 17 years, and was stationed at Dewsbury prior to the transfer of the staff to Leeds about a year ago.

MR. B. CUDE.—The death occurred on February 6th, as the result of injuries sustained whilst motor-cycling, of Mr. Bert Cude, who was a member of the engineering staff of the Leatherhead Electricity Works. He was 24 years of age.

MR. H. HOWARD.—The death occurred, suddenly, on February 14th, of Mr. Henry Howard, who was electrical engineer to Lord Norbury, of Greenwood, Withyham, Sussex. He was 40 years of age.

MR. A. P. LUNDBERG.—We regret to learn, at the moment of going to press, that Mr. A. P. Lundberg, M.I.E.E., passed away on February 22nd, after a long illness, in his 95th year.

PROF. H. K. ONNES.—We regret to record the death of Prof. Heike Kamerlingh Onnes, Emeritus Professor and Director of the Physical Laboratory at Leyden University. He was born at Groningen in 1853, and became Professor of Experimental Physics in 1882 at Leyden, where he carried out researches on gases at high pressures and low temperatures, which culminated in the liquefaction of helium in 1908 at 4.5 degrees on the absolute scale. Later, he attained a temperature of about one degree above absolute zero, and he proved that, as had long been anticipated, the electrical resistance of metals practically disappeared in the neighbourhood of the absolute zero of temperature. He was awarded the Nobel prize for physics in 1913, and the Rumford medal of the Royal Society in 1916, besides receiving many other distinctions.

MR. MARTIN F. ROBERTS.—We learn with deep regret that Mr. Martin Fenn Roberts, M.Inst.C.E., M.I.E.E., F.C.S., passed away suddenly on February 22nd, at Brandshatch Place, Fawkham, Kent, at the age of 72 years. Mr. Roberts was a director of W. T. Henley's Telegraph Works Co., Ltd. He was formerly assistant engineer-in-chief to the General Post Office.

Will.—The late SIR G. S. GIBB left £46,501 gross and £40,815 net personalty.

New Companies Registered.

Shipton Automatic Telephone System, Ltd. (211,744).—Private company. Registered February 15th. Capital, £100 in £1 shares. Objects:—To carry on the business of telephone, telegraph, electrical, mechanical, and general engineers, manufacturers of, and dealers in, importers and exporters of, and dealers in instruments, accessories, components, and installations used in connection therewith, &c. The directors are:—E. Shipton, A.M.I.E.E., 2, Belgrade Road, Stoke Newington, N.16 (managing and permanent director); E. J. Baker, 4, Oxford Road, Snakes Lane, Woodford; V. A. P. Stokes, Frog Hall, Wokingham. Solicitors: Rubenstein, Nash & Co., 5 and 6, Raymond Buildings, Gray's Inn, W.C. Registered office: 37, Tothill Street, Westminster.

Elpar, Ltd. (211,715).—Private company. Registered February 13th. Capital, £2,000 in 500 6 per cent. cumulative preference and 1,500 ordinary shares of £1 each. Objects:—To adopt an agreement with A. C. Chapple and to carry on and turn to account the business of an electrical, mechanical, and radio engineer carried on by him at 20, Eltham Road, Lee Green, Kent. The directors are:—A. C. Chapple, 39, Woodside Crescent, Sidcup, Kent; A. T. K. Moir, 46, Wisteria Road, Lewisham, S.E.13, electrical engineer; V. W. Cunis, 40, Hampden Avenue, Beckenham, Kent, engineer. Remuneration as fixed by the company. Secretary: A. C. Chapple, 20, Eltham Road, Lee Green, Kent. Solicitors: Lendon & Carpenter, 31, Budge Row, E.C.4. Registered office: 20, Eltham Road, Lee Green, Kent.

Siemens and General Electric Railway Signal Co., Ltd. (211,382).—Registered as a "private" company on January 28th (delayed at Somerset House), with a nominal capital of £30,000 in £1 shares (10,000 "A" and 10,000 "B"). The "A" and "B" shares rank *pari passu* as a single class, except that they confer certain rights of appointing directors. The objects are to acquire the goodwill, stock, and assets referred to in an agreement between the General Electric Co., Ltd., of the first part, Siemens Bros. & Co., Ltd., of the second part, and this company of the third part, to design, manufacture, and deal in railway signalling installations and apparatus, to construct and carry out railway, electrical, and other works and conveniences, &c. The first directors are:—Max J. Railing, "Whiteknights," Reading (director of General Electric Co., Ltd.); Sydney D. White, "Arundel," Upper Brighton Road, Surbiton, Surrey (director of General Electric Co., Ltd.); Francis Hird, Lanark House, Fairfield Road, Old Charlton, S.E. (director, Siemens Bros. & Co., Ltd.); Dr. Hy. R. Wright, 51, Westcombe Park Road, Blackheath, S.E.3 (general manager, Siemens Bros. & Co., Ltd.). The first two named represent the "A" and the last two named the "B" shareholders. No qualification required. Remuneration as fixed by the company. Secretary: A. M. Hicks. Solicitors: Wild, Collins & Crosse, Kennan's House, Crown Court, Cheapside, E.C.2. The registered office is at Caxton House, Tothill Street, S.W.1.

E. A. Wilson & Co., Ltd. (211,770).—Private company. Registered February 16th. Capital, £1,000 in £1 shares. Objects:—To acquire the business of a manufacturer of wireless components, engineer and brass founder carried on by E. J. C. Liney (formerly carried on by E. A. Wilson), at 88, Shadwell Street, Birmingham, as "E. A. Wilson & Co." The permanent directors are:—E. J. C. Liney, 164, Orphanage Road, Erdington, Birmingham; and E. A. Wilson, 13, Woodall Road, Witton, Birmingham. Qualification, 100 shares. Solicitors: A. C. Jaques, 162, Colmore Road, Birmingham. Registered office: 88, Shadwell Street, Birmingham.

Fountain Bros., Ltd. (211,790).—Private company. Registered February 17th. Capital, £1,000 in £1 shares. Objects: To carry on the business of manufacturers of, dealers in and agents for all kinds of ironmongery and builders' materials, electrical machinery, plant, switchgear, apparatus and supplies, cables, &c. The subscribers (each with one share) are:—H. J. Fellowes, 56, Rathcoole Gardens, Hornsey, N.8, solicitor's clerk; W. C. Paske, 31, Amerland Road, Wandsworth, S.W.18, solicitor's clerk. The first directors are: H. J. Fountain and P. G. Fountain. Solicitors: P. S. Solomon, Archer & Co., 110, Cannon Street, E.C.4.

Anodon, Ltd. (211,864).—Private company. Registered February 19th. Capital, £15,001 in 10,000 "A" and 5,000 "B" shares and 1 arbitrator's share of £1 each. The arbitrator's share shall not confer upon the holder any right to participate in the profits, but shall rank for repayment of capital *pari passu* with the "A" and "B" shares. Objects:—To adopt an agreement with I. Knowles and F. J. Knowles, and to carry on the business of manufacturers of, agents for, and dealers in wireless and electrical instruments and accessories, &c. The subscribers are:—**H. T. Phillips, 247, Evering Road, Clapton, E.5, confectioner, 1 "B" share;** I. Knowles, "Stonyhurst," Chalfont St. Peter, merchant, 1 "A" share. The above subscribers shall be two of the first directors and shall be permanent. There may from time to time be appointed in respect of the company an arbitrator director. Solicitors: Horner & Horner, Fitzalan House, Arundel Street, W.C.2.

Ballycastle Electric Light and Power Co., Ltd. (B.I.304).—Private company. Registered in Belfast on February 3rd. Capital, £7,000 in £1 shares. Objects:—To carry on the business indicated by the title. The directors are:—J. McKavanagh, 26, Ballyholme Esplanade, Bangor, gentleman; J. Dobbin, 136, Manor Street, Belfast, electrical engineer; W. McPeake, 136, Manor Street, Belfast, electrical engineer; J. Smyth, 65, North Street, Newtownards, electrical engineer. Qualification, 500 shares. Secretary: J. Dobbin. Registered office: 133, Royal Avenue, Belfast.

Rowland's Electrical Accessories, Ltd. (211,738).—Private company. Registered February 13th. Capital, £1,000 in £1 shares. Objects:—To carry on the business of manufacturers, importers, exporters, and repairers of, agents for and dealers in electric light fittings and accessories, general electrical goods, and instruments for use in connection with radio or wireless-telegraphy and telephony, &c. The permanent directors are:—W. R. Hill, "Seaward," The Cliff, Roedean, Brighton; O. R. Hill, 11, Broadfields Road, Erdington, Birmingham. Qualification, 1 share. Secretary: O. R. Hill.

Official Returns of Electrical Companies.

Associated Battery Co., Ltd.—F. W. Pixley, of 58, Coleman Street, E.C.2, ceased to act as receiver or manager on December 31st, 1925.

New Welding Co. (Southern), Ltd.—C. G. Arnold, of 26, Rosebery Avenue, E.C., was appointed receiver and manager on February 9th, 1926, under powers contained in debentures dated November 7th, 1923.

Electrical Insulating Composition Co., Ltd.—J. Lucas, of 26, Birley Street, Blackpool, I.A., ceased to act as receiver or manager on December 31st, 1925.

British Automatic Telephone Installation Co., Ltd.—Debenture dated January 27th, 1926, to secure £300, charged on the company's undertaking and property, present and future, including uncalled capital. Holder: S. F. O'Hara, 148, Shaftesbury Avenue, W.C.2.

Win-Sum Electric Diffusers, Ltd. — Particulars filed of £1,000 debentures authorised January 27th, 1926, charged on the company's undertaking and property, present and future, including uncalled capital, the whole amount being now issued.

Rose Bros. Electrical Co., Ltd. (175,986).—Capital, £20,000 in £1 shares. Return dated October 26th, 1925. 10,002 shares taken up. £2 paid. £10,000 considered as paid. Mortgages and charges, £5,000.

Robin Electric Lamp Co., Ltd. (125,723).—Capital, £75,000 in £1 shares. Return dated October 29th, 1925. 60,352 shares taken up. £10,300 paid. £50,000 considered as paid. £52 in arrears of calls. Mortgages and charges, nil.

Barnsley and District Traction Co., Ltd. (72,962).—Capital, £125,000 in 50,000 preference and 75,000 ordinary shares of £1 each. Return dated June 24th, 1925. 22,000 preference and 60,105 ordinary shares taken up. £62,070 paid on 22,000 preference and 40,070 ordinary shares. £20,035 considered as paid on the remainder. Mortgages and charges, £19,928 4½ per cent. debenture; £29,000 second debenture issued to bankers as collateral security.

Shoreham and District Electric Lighting and Power Co., Ltd. (176,995).—Capital, £27,500 in £1 shares. Return dated December 31st, 1925. 17,329 shares taken up. £10,579 paid. £6,500 considered as paid. £250 in arrears. Mortgages and charges, nil.

Tubes, Ltd. (91,224).—Capital, £150,000 in £1 shares. Return dated October 27th, 1925. All shares taken up. £107,584 paid (being £1 per share on 82,859 and 10s. per share on 49,450 shares. £42,416 considered as paid (being £1 per share on 17,691 and 10s. per share on 49,450 shares). Mortgages and charges, nil.

Nox Electric Lamp Co., Ltd. (189,377).—Capital, £2,000 in £1 shares. Return dated December 31st, 1925. 502 shares taken up. £2 paid. £500 considered as paid. Mortgages and charges, debentures £662 13s. 4d.

Pirelli, Ltd. (103,068).—Capital, £250,000 in £1 shares. Return dated December 11th, 1925. 200,000 shares taken up. £200,000 paid. Mortgages and charges, nil.

Llangefni Electric Light and Power Co., Ltd. (11,909).—Capital, £3,000 in 2,750 preference and 250 ordinary shares of £1 each. Return dated November 2nd, 1925. 2,566 preference and 250 ordinary shares taken up. £2,566 paid. £250 considered as paid. Mortgages and charges, £2,400.

West India and Panama Telegraph Co., Ltd. (11,116).—Capital, £2,445,630 in 34,563 first preference, 10,000 second preference, and 200,000 ordinary shares of £10 each. Return dated November 4th, 1925. 34,563 first preference, 4,669 second preference, and 88,321 ordinary shares taken up. £1,275,530 considered as paid. Mortgages and charges, £89,100.

Callender's Cable & Construction Co., Ltd. (48,915).—Capital, £1,300,000 in 500,000 ordinary, 400,000 preference, and 400,000 "B" preference shares of £1 each. Return dated June 11th, 1925. All shares taken up. £1,025,000 paid. £275,000 considered as paid. Mortgages and charges, £300,000.

City Notes.

Reports and Meetings of Electrical Companies, Dividend Results, &c.

The "Underground" Group.

We have received copies of the reports of the companies forming this group which were to be presented at the annual meetings yesterday (Thursday); they are summarised below:—

London Electric Railway Co.—The traffic receipts rose by £52,462 to £1,914,183, while the expenditure decreased by £4,609 to £1,131,814, leaving net receipts of £782,369—an increase of £57,071. The addition of miscellaneous revenue and £74,506 brought forward, gave an available balance of £1,045,331. Interest, rentals, &c., absorbed £452,625; £45,000 has been transferred to reserve (as in 1924); preference dividends required £126,947; a total dividend of 3½ per cent. on the consolidated ordinary stock took £326,478; and a balance of £94,281 is carried forward. During the year the capital expenditure amounted to £949,776, the principal items being £471,513 in respect of the Charing Cross-Kennington extension and £305,143 for rolling stock. It is expected that the extension referred to will be opened for traffic about the middle of this year. A short connecting line is to be constructed between the Piccadilly section and the City and South London Railway at King's Cross. The new joint booking hall at Oxford Circus has been put into service.

Central London Railway Co.—The traffic receipts amounted to £511,346 (£36,621 decrease) and the expenditure to £340,250 (£32,741 decrease), leaving net receipts of £171,096, a fall of £3,880. To this were added miscellaneous receipts (£88,861) and the balance brought forward (£85,885), making £345,842, a decrease of £9,164. After providing for interest, rentals, &c., and preference dividend, transferring £40,000 to reserve (as in 1924), and paying a total dividend of 4 per cent. on the three classes of ordinary stock, a balance of £81,008 is carried forward. The year's capital expenditure was £182,591, of which the installation of escalators accounted for £158,992. The shareholders were to be asked to approve the promotion of a Bill to empower the company to raise additional capital and to carry out new works jointly with the Metropolitan District Railway Co. Considerable progress was made with improvements during the year

City and South London Railway Co.—The traffic receipts at £539,310 were higher by £226,884, and the expenditure rose by £150,239 to £265,633. The net receipts were thus £273,677, an increase of £76,645. To this were added miscellaneous receipts of £42,877 and £18,766 brought forward, making £335,320. After transferring £25,000 to reserve and providing for interest and dividends (including 3 per cent. on the consolidated ordinary stock), a balance of £25,037 is carried forward. The capital expenditure was £1,466,299, the bulk of which (£1,040,897) was taken by the Clapham Common-Morden extension. It is anticipated that this extension will be ready for service by the middle of the year. The remodelling and improvement of the company's existing stations was continued during the year.

Metropolitan District Railway Co.—The traffic receipts amounted to £1,634,778 and the expenditure to £1,102,085, representing decreases of £14,744 and £39,475 respectively. The net revenue was thus £532,692, an increase of £24,731. To this was added miscellaneous receipts of £184,058 and £69,230 brought forward, making £785,981. The allocations included £45,000 to reserve and a total dividend of 3¼ per cent. upon the ordinary stock, and £69,230 is carried forward. The capital expenditure was only £27,331, mainly upon manufacturing and repairing works and plant.

Summary of Results.—We reproduce below a comparative statement of the results of the four companies which, with the London General Omnibus Co., Ltd., participate in the "Common Fund":—

	1925. £	*Increase+ Decrease−* £
Traffic receipts	13,243,652	+473,451
Expenditure	11,088,255	+268,572
Net receipts	2,155,397	+204,879
Miscellaneous receipts (net)	834,144	+ 34,092
Total net income	2,989,541	+238,971
Deduct—		
Interest, rentals and fixed charges	1,320,545	+164,176
Appropriation to reserve for contingencies and renewals	455,000	+ 50,000
Dividends on guaranteed and preference stocks ...	389,477	—
Total deductions ...	2,165,022	+214,176
Balance	824,519	+ 24,795
Add balances from last year's accounts	308,889	− 74,888
Total amount available for dividends on ordinary stocks and shares and for other purposes	1,133,408	− 50,093
Amount paid in dividends on ordinary stocks and shares representing an average rate of 4.09 per cent. in 1925 and 4.43 per cent. in 1924	808,234	− 66,378
Balance carried forward to next year's accounts ...	325,174	+ 16,285

With the exception of the City and South London Railway (for which 1924 was an abnormal year), the railways showed decreased traffic, but the increase in the number of passengers carried by the C. & S.L. Railway caused a net increase in the total. The figures for the four companies were as follows:—

Passengers carried:—	1925.	
Ordinary	217,914,496	+12,033,369
Workmen	51,416,986	+ 5,937,680
Seasons	49,370,358	+ 2,374,708
Total ...	318,701,840	+20,345,757
Number of car-miles run	65,436,713	+ 6,540,634

The total capital of the four railway companies is £53,379,364—a slight increase. In addition, the capital of the Lots Road Power House Joint Committee amounts to £3,175,000.

Metropolitan Railway Co.

Lord Aberconway (the chairman) presided at the annual meeting on February 18th. In moving the adoption of the report and accounts (*vide* our last issue, p. 306) he said that the year 1924 with which those accounts were compared, was an exceptionally good year for the company

owing to the heavy traffic in connection with the British Empire Exhibition, and the strike which occurred in that year among tramway and 'bus employés, which gave the company a large amount of extra traffic. The attendance at Wembley in 1925 was only about half that of the previous year, and the company's receipts were not even half of those obtained in 1924, owing to the reduction in the price of tickets. Therefore, it was not surprising that the revenue for 1925 showed a considerable decrease, but the same dividend was being paid, as the company had considerably strengthened its financial position from the surplus accumulated in 1924; they had not, however, been able to transfer £25,000 to the general reserve fund again. The latter fund now stood at £125,000, and they did not consider it necessary to increase it further. The capital expenditure during the year amounted to £252,844; a number of important works were covered by this figure, some of which were already in use, while others were under construction. The new junction between the Circle and the widened lines to the east of Euston Square was approaching completion. The capital account was overdrawn to the extent of £1,144,000, but they had taken a favourable opportunity of disposing of 750,000 3½ "A" debenture stock, which had reduced the debit by nearly one half. Further stock would be issued to put the account in order.

Turning to the revenue account, the chairman said that they had a very substantial reduction in working expenses as a set-off against the smaller traffic receipts. That was partly due to the special provision made out of the income for 1924, and partly to the economies which had been effected. Referring to the omnibus and other road competition, Lord Aberconway said that assessments to local rates were continually increasing, and a part of the money paid in that way went towards the upkeep of the roads which their competitors were using. They found that their short distance traffic was shrinking in its proportions. The company had a Bill before Parliament which would provide for the extension of the electrified system into the country districts served by the railway. This would lead to the development of those districts, with a subsequent ever-increasing traffic. They would, however, not be in a position to contemplate further extensions north and west of Harrow until some alternative entrance had been provided to Baker Street, and the Circle lines, and the veritable bottle-neck that now existed on the City side of Finchley Road had been done away with. The company's proposal was to make a new railway leaving the present lines by a junction between Kilburn and Willesden Green, joining up with the Circle lines on the west side of their Edgware Road station. By this means a shorter and straighter route would be provided for fast trains, and new ground would be broken, as there would be three stations at convenient points on the Edgware Road, from which considerable traffic could be derived. The report and accounts were adopted.

Yorkshire Electric Power Co.

The annual meeting of this company was held at Leeds, on February 16th. Mr. A. G. Lupton (chairman), who presided, in presenting the report and accounts (ELEC. REV., February 12th, p 266) said that steady progress had been made during the past year, and the additional connections to the company's system were larger than in the preceding year. The recent fall in the cost of coal had enabled them to reduce their charges to consumers. The extensions at the Thornhill power station were completed, and the installation of a further 20,000-kW set had been sanctioned. The construction of the Ferrybridge station had proceeded during the year, and a limited supply was made available in January last. The chairman then reviewed the situation of the company under the Electricity Supply Acts, and stated that the proposal to cut the area of the company into two main portions, had had to be abandoned. This had led to considerable delay in the construction of the Ferrybridge station, and the board had finally decided that further attempts to carry out a scheme for a joint electricity authority could be of no avail, and that the company must proceed with the development of its area on the lines laid down by the Yorkshire Electric Power Act. The Distribution Company's activities, like those of the Power Co. had been checked while the Commissioners were considering the reorganisation schemes. The Distribution Co. had asked for orders permitting it to distribute in practically all the unprovided districts in the Power Co.'s area, but these had not yet been obtained. It was the original purpose of the company to provide electricity on a large scale, to enable small unprofitable stations to be closed down. Very considerable progress had been made, and a number of small stations had been closed down, and supplies were being taken from the Power Co. These had enabled the local authorities to materially reduce the price of electricity. When the Ferrybridge station was running, in the course of next summer, the company would have a total generating capacity of 93,500 kW in its three stations. In addition it would have completed some 50 miles of e.h.p. lines and 700 miles of distributing mains. The company had 340 sub-stations in operation, and in addition to supplying collieries, textile mills, engineering works, &c., the number of distributing undertakings associated with the company was 57. There was a constantly increasing demand from local authorities. The standards of pressure and frequency set by the company in 1901 were the accepted standards for the country, and new undertakings in the company's area had adopted them while old undertakings were gradually converting to them at their own cost. The area of the Yorkshire Power Co. adjoined that of other companies, which also supplied electricity at one standard frequency. The prospects of co-operation had not been overlooked, and when the need arose it could be effected without the establishment of any new organisation. He (the chairman) could not believe that any necessity existed for interfering with the development of supply on the lines which the company had followed for so many years. The opposition which the company had met in the past, from the large municipalities, was changing to a more cordial relationship, and in a few years all outstanding difficulties should be removed, and complete co-operation established. Referring to Mr. Baldwin's electricity proposals, Mr. Lupton said that at present the company could only supply electricity for power purposes. It could not light a person's house, even though the mains ran past his door. The removal of this disability would do much to speed up the use of electricity. Mr. Baldwin's scheme suggested the establishment of a small body to deal with the electrical needs of the country as a whole; he could hardly conceive that such a body would be able to know the needs of the different industrial areas so well as the various boards of directors and power companies which were serving them. Turning to the company's capital, the chairman said that an issue of 500,000 £1 ordinary shares was made last February, and the whole of this was taken up by the shareholders. At last year's meeting, authority was given for the issue of £773,000 of new capital. The directors now proposed to issue 765,000 £1 6 per cent. preference shares to the present holders of ordinary and preference shares. Further capital would be required, and it was proposed to apply to Parliament for an increase in the share capital of the company, to six millions. The report and accounts were adopted, and at a subsequent extraordinary meeting resolutions were passed approving of the application to Parliament for an increase in the company's capital, and sanctioning the donation of £5,000 to the Leeds University Fund.

Tottenham District Light, Heat and Power Co., Ltd.

The annual meeting was held on February 16th under the chairmanship of Mr. H. Woodall. In presenting the report and accounts, the chairman referred to the death of Mr. H. D. Ellis and the appointment of Mr. T. Goulden to fill the vacancy upon the board. Referring to the Government's electricity scheme, Mr. Woodall said that, while he viewed with alarm any incursion of Government into industry, which was much better left in private hands, he recognised that public service companies must be controlled, and the gas legislation had been, on the whole, a model of what such control should be. Coal should be carefully conserved, and it should be remembered that while 80 per cent. of the heat content was recovered in gasworks, in the generation of electricity only 20 per cent. was recovered. There were well-known authorities on electrical matters who were not satisfied as to the advantages of the Government's Electricity Bill. Any powers needed for the cheaper and better production and distribution of electricity could be obtained in the ordinary way, by application to Parliament. The Government proposals were "boosting" the electrical industry, which could be trusted to "boost" itself, with the result that it and allied industries were receiving a valuable advertisement. The electrical industry had been described as one of the bright spots in an otherwise dark picture. It was true that the electrical industry was prosperous, but from a national point of view it would be more true to say that the gas industry was the brighter spot in the picture. The electrical industry was paying large dividends and using coal extravagantly, while the gas industry was paying small dividends, using coal to much greater advantage, and had many schemes for the welfare of its workers, which, he believed, had no counterpart in the electrical industry. In the model Gas Bill discounts were limited to 25 per cent., whereas electricity was charged for, for one purpose, at as much as 10 times the rate as for another in the same dwelling. He thought that the general public would be better served if the price of lighting was considerably reduced even if the price for heating and power was raised. Large users of power could always generate electricity for themselves at a lower price than it could be distributed to them.

Prospectus.

London Power Company Ltd.—The list of applications was to close on or before yesterday, Thursday, in an issue of £3,000,000 five per cent. redeemable debenture stock at £96 per cent. In actual fact, however, so swift was the response, that it closed on Monday a few hours after publication. The company was formed in 1920 as a private company, under the name of the London Electricity Joint Committee (1920) Ltd., to secure the co-operation of the London electricity supply companies in the promotion of a scheme for the better development of the supply of electricity in London and Middlesex, and neighbouring districts. The company became a public company and changed its name on the passing of the London Electricity (No. 2) Act, 1925, and under contracts scheduled to and confirmed by that Act and made with ten London electricity supply companies represented on the board, it has agreed to purchase the freehold of the Willesden and Amberley Road generating stations, and certain transmission lines of the Metropolitan Electric Supply Co., Ltd., and to take on lease the generating stations and main transmission lines of the other constituent companies on terms under which such stations and lines will be acquired by the company on or be-

fore August 25th., 1971. The Act empowers the company by agreement with any constituent company to acquire its station and lines at any earlier date.

The company will operate the generating stations taken over and will supply the constituent companies with the energy required for the purposes of their businesses. Nine of the ten constituent companies have (subject to certain existing contracts for bulk supply) bound themselves by the contracts ratified by the Act of 1925 to take from the company all the electricity they require for supply by them until 1971. The other company (The Metropolitan Electric Supply Co., Ltd.) has bound itself to take from the company for at least ten years all the electricity it may require for its London area of supply.

Each of the ten constituent companies has by such contracts further agreed with the company that if in any year the receipts of the company on revenue account are insufficient to meet the charges payable therefrom (which include interest on the debenture stock and contributions to the sinking funds which the company is required by the Act to establish for amortisation of capital expenditure), such constituent company will provide a part of the deficiency equal to the proportion that the amount paid by it for electricity purchased by it during the year bears to the total amount paid for electricity supplied by the company during that year.

The aggregate number of kWh sold by the ten constituent companies during each of the last three years ended December 31st (excluding inter-company sales) has been as follows:—1923, 190,657,426; 1924, 215,952,957; 1925, 263,113,970.

The proceeds of the present issue are required to provide for the acquisition and extension of certain of the existing generating stations and main transmission lines and to pay off obligations of some of the constituent companies and for the general purposes authorised by the Act of 1925. The share capital of the company is £50,000, divided into 50,000 shares of £1 each, all of which has been issued at par for cash and is fully paid up, and is all held by the constituent companies. The holders of this capital have the exclusive right of nominating directors of the company. Preferential consideration was to be given to applications from debenture holders and shareholders of the ten constituent companies, the representative of which are stated below:—

W. F. Fladgate, M.V.O., Charing Cross Electricity Supply Co., Ltd.
H. R. Beeton, Brompton and Kensington Electricity Supply Co., Ltd.
R. H. Benson, London Electric Supply Corporation, Ltd.
W. R. Davies, Chelsea Electricity Supply Co., Ltd.
A. E. Franklin, Notting Hill Electric Lighting Co., Ltd.
W. Leaf, Central Electric Supply Co., Ltd.
A. W. Tait, C.B.E., Metropolitan Electric Supply Co., Ltd.
F. J. Walker, St. James' and Pall Mall Electric Light Co., Ltd.
Lord Wargrave, Westminster Electric Supply Corporation, Ltd.
C. C. Wyllie, Kensington and Knightsbridge Electric Lighting Co., Ltd.

The engineers are: Sir Alexander Kennedy and Mr. G. W. Partridge.

Northampton Electric Light and Power Co., Ltd.

The annual meeting was held on February 18th. Mr. A. H. Geldart (deputy chairman) presided, and in presenting the report and accounts (*vide* our last issue, p. 305), said that in spite of a very small increase in the demand from Northampton's staple trade, the energy sold had risen by 21.7 per cent., and although prices had been reduced, the revenue had exceeded the estimates. The greater output had led to a reduction in the working costs per kWh generated. The shareholders were to be asked to agree to the extension of the capital to £500,000. The programme for the ensuing year included extensions to Towcester, Bletchley and Fenny Stratford, and the completion of the ring mains to Daventry and Wolverton back to Northampton. An extension of 8,000 kW was being made at the Hardingstone Junction power station to cope with the demand. The report was adopted.

At a subsequent meeting a resolution was put forward to empower the board to issue 150,000 additional £1 "B" shares. The chairman said that only £60,000 of this would be issued at present—at the price of 28s. per share—to existing shareholders. It was suggested that the price should be 26s., but the chairman would not accept the amendment. Eventually the resolution was lost, on a show of hands, by a large majority.

Dublin United (Electric) Tramways Co., Ltd.

Mr. Joseph Mooney, chairman, presided at the recent annual meeting, when the report and statement of accounts were adopted and a dividend of 5½ per cent. was declared. The number of passengers carried in 1925 showed a slight increase as compared with 1924, but the revenue from this source decreased, which was attributable to the higher percentage of short-distance passengers. There was a decrease in revenue in the second half of the year which, the chairman said, was believed to be due to a decrease in the spending power of the travelling public. The new motor-'bus services to outlying districts were successful; more 'buses were nearing completion, and it was hoped to open up more routes soon.

Mr. Mooney alluded to the increase in traffic wages, which, he observed, pressed heavily on their resources. There had been some relief under the head of rates for the year, and they looked forward hopefully to a further reduction in these charges. As to the taking over of the Lucan Electric Railway by the company and the extension of their line through the Liffey Valley, terms had been arranged with the Dublin authorities and some of the townships whereby the period of tenure was extended; some townships, however, had not yet come to a decision.

North Metropolitan Electric Power Supply Co.

The report for the year ended December 31st last, records a net revenue of £315,292 (as compared with £272,483 in 1924). The addition of £7,297 brought forward gives an available balance of £322,589. Mortgage, debenture stock interest, &c., is paid, and £150,000 is transferred to reserve, leaving £125,452, which is allocated as follows:—Dividend on the two classes of preference shares, £55,999; final dividend on the ordinary shares, making 10 per cent. for the year, £62,777; carried forward, £6,676. During the year the capital expenditure upon plant, machinery, and mains amounted to £345,123. Approximately 160 miles of trunk and distributing mains have been laid and 35 new sub-stations have been put into service. The company's system is being linked up with the Barking station of the County of London Electric Supply Co., Ltd., and has been connected with the Metropolitan Electric Supply Co., Ltd. Arrangements are being made for the erection of a new generating station at Brimsdown. A supply of electricity was commenced at Potters Bar, Totteridge, Goldings, Hertingfordbury, and Upshire. Charges for supply have been reduced in the majority of the company's districts, and to authorised distributors. The total amount of energy sold was 112 million kWh, as compared with 96¼ millions in 1924, an increase of 16 per cent. The number of consumers supplied, directly or indirectly, at the end of the year was 56,500, as against 45,500—an increase of 23 per cent. New showrooms have been opened at Edgware, Harpenden and Southgate. The meeting was held on Tuesday last.

Tyneside Tramways and Tramroads Co.

The half-yearly meeting was held on February 16th. Mr. G. E. Henderson (chairman), in moving the adoption of the report, said there had not been any improvement in the shipbuilding, engineering, coal and other ancillary industries during the year, but rather the reverse, and as the tramways went through an area principally engaged in those industries, both their ordinary and workmen's traffic had been seriously affected by continued and increasing depression, which accounted for their diminished receipts. Their traffic receipts for the year amounted to £39,105, as against £43,343 for 1924, a decrease of £4,237. The passengers also showed a decrease of 366,582. During the year they had been able to reduce their working expenses by £2,410, so that the gross profit of £4,457 was only £1,753 less than that for 1924. They were not able to pay a dividend on the preference shares for the past year. During the year they had added to their reserve funds £1,650, but they had taken from that fund, so that it stood at £27,027, against £30,372 at the end of 1924.

Scottish Power Co., Ltd.

The net trading profits for 1925 of the undertakings owned and operated by this company amounted to £58,044, of which £10,000 was allocated to the reserves of these undertakings. The balance remaining after meeting expenses and adding £2,503 brought forward is £45,099. After defraying interest, preference dividends, &c., and placing £7,641 to reserve, a dividend at the rate of 8 per cent. is to be paid on the ordinary shares, and £2,702 is carried forward. Transmission and distribution cables have been considerably extended, and additional boiler plant has been installed. It is stated that the services now approach the limits of the company's area of supply. The shareholders may be asked during the current year to sanction an increase in the company's capital. Meeting: To-morrow (Saturday).

Midland Counties Electric Supply Co., Ltd.

The trading profits for 1925 of the companies owned and operated by this concern totalled £171,506, and the balance at credit of profit and loss (including £4,457 brought forward) is £146,727. After meeting debenture interest, interim preference dividend, &c., and transferring £15,000 to reserve, there remains £83,974. A dividend at the rate of 6 per cent. is proposed on the ordinary shares, leaving £4,732 to be carried forward. The company reports a satisfactory increase in the demand which has led to considerable capital expenditure that should be productive in the near future. The traction section failed to contribute in the aggregate to the trading profits. Meeting: March 1st.

Power Securities Corporation, Ltd.

The third annual meeting was held last week, Mr. G. Balfour, M.P., presiding. In the course of his speech, the chairman said that they had proceeded cautiously, and confined their attention to general engineering and electrical development work, and to financial and underwriting business connected with public utility undertakings and public authorities. The electricity supply business in this country had made rapid strides since it was freed from the distraction of legislative proposals, and money was freely found to keep pace with the demand. Referring to the Government's electricity proposals, Mr. Balfour said that he hoped that the Government would confine them to removing and not imposing restrictions. The existing undertakers should be assisted in developing their areas, and private enterprise should be attracted to areas not yet covered. Coming to the company's own affairs, the chairman said that further progress had been made in connection with the Grampian electricity scheme. For the purpose of consolidating the areas, they had acquired two small electricity

undertakings, and were negotiating for two larger undertakings in the area. The volume of work carried out by Balfour, Beattie & Co., Ltd., was well up to that of previous years. Among the contracts being carried out by them was the Lochaber scheme, which would probably continue for another two years. The company's investments stood at £846,793; of this 37 per cent. was invested in electricity supply and allied undertakings, 29½ per cent. in Balfour, Beattie and Co., about 17 per cent. in British Government securities, and 16½ per cent. in industrial securities. The year's gross profit was £96,412, and the net balance £77,965, plus the sum brought forward, making £86,523. £20,000 was transferred to reserve, and the ordinary shares received a dividend of 6½ per cent.

London Electric Supply Corporation, Ltd. The report for the year ended December 31st last records a profit of £202,426, as compared with £164,863 in 1924. To this is added £32,285 from the last account, and from it is deducted interest of £5,704 on a temporary loan, making £229,007. After providing for interest and sinking fund, there is an available balance of £188,933, which is to be allocated as follows:—Preference dividend, £41,952; ordinary dividend (10 per cent. for the year), £49,950; to reserve, £30,000; to depreciation, £30,000; to contingencies, £5,000; carried forward, £32,031. The sales of energy rose from 61,809,968 kWh to 90,905,284 kWh—an increase of 47 per cent. The average receipts per kWh sold were reduced from 1.56d. to 1.22d. The report makes reference to the developments in connection with the reorganisation of London's electricity supply, and states that the directors are taking the necessary steps to carry out the arrangements embodied in the London Electricity (No. 2) Act, 1925. The meeting is to be held to-day (Friday).

Isle of Thanet Electric Supply Co., Ltd. The revenue for the year ended December 31st last was £137,990, and the expenditure £85,739, leaving net revenue of £52,251. Debenture interest, &c., absorbs £15,000, and £20,000 is transferred to reserve, and interest of £1,201 and a balance brought forward of £1,403 are added, making a net available balance of £19,854. After paying the preference dividend and one of 2½ per cent. on the ordinary shares, a balance of £3,504 is to be carried forward. Over 750 new consumers were added during the year, and an additional 3,000-kW set was installed to meet the growing demand. To provide capital for cable extensions, &c., the shareholders are to be asked to approve of the increasing of the company's capital by £140,000; £72,000 of this is to be issued forthwith in the form of 6 per cent. cumulative preference shares, which will be offered to shareholders at par, in the proportion of one to five. Meeting: March 1st.

Smithfield Markets Electric Supply Co., Ltd.—The net profit for the past year was £7,670 (after providing for debenture interest, &c., and depreciation); £2,022 brought forward is added, making £9,693. A final dividend at the rate of 5 per cent. is recommended upon the ordinary shares, making 8 per cent. for the year; £2,500 is transferred to general reserve, and £2,393 is carried forward. The output showed a considerable improvement over that of 1924. The report refers to the death of Mr. J. Browne Martin, a director of the company since its inception; it is not proposed to fill the vacancy thus created. The meeting was to be held yesterday (Thursday).

Electrical Distribution of Yorkshire, Ltd.—The accounts for the past year show a net profit of £31,099. To this is added £10,838 brought forward, making £41,937. A dividend at the rate of 7 per cent., free of tax, is paid on the ordinary shares (3½ per cent. was paid in August last); £10,000 is transferred to reserve; and £14,114 is carried forward. A continuous and growing demand is reported, particularly for domestic use. Further Orders have been approved by local authorities, and await the Electricity Commissioners' decision. The issue of 250,000 ordinary shares made last year was considerably oversubscribed by existing shareholders. Meeting: March 2nd.

Stock Exchange Notices.—The undermentioned securities have been ordered to be officially quoted:—

Johnson & Phillips.—100,000 ordinary shares of £1 each, fully paid, Nos. 500,001 to 600,000.
Vickers.—12,315,483 ordinary shares of 6s. 8d. each, fully paid, Nos. 1 to 8,190,817 and 8,190,968 to 12,315,633.
General Electric Co.—30,000 ordinary shares of £1 each, fully paid, Nos. 2,111,976 to 2,141,975.

Dealings in the following have been specially allowed by the Committee under Rule 159:—

General Electric Co.—30,000 ordinary shares of £1 each, fully paid, Nos. 2,111,976 to 2,141,975.
Yorkshire Electric Power Co.—765,000 new 6 per cent. cumulative preference shares of £1 each, issued at 21s., partly and fully paid, Nos. 838,001 to 1,603,000.

South Metropolitan Electric Light and Power Co., Ltd.—Final dividend of 10 per cent. on the ordinary shares, making 15 per cent., as in 1924.

Bournemouth and Poole Electricity Supply Co., Ltd.—Final dividend of 5½ per cent., making 10 per cent. for the year, on the ordinary shares, plus a bonus of 4 per cent., free of tax, as in 1924.

Richmond Electric Light and Power Co., Ltd.—A dividend of 10 per cent. has been declared on the old ordinary shares, as in 1924.

Companies to be Struck off the Register.—The names of the undermentioned companies will be struck off the Register at the expiration of three months, unless cause is shown to the contrary:—

Auto Electrical Services, Ltd.
Newcastle and Sunderland Oxy-Electric Welding and Metallurgical Co., Ltd.
Perak Hydro-Electric Power Syndicate, Ltd.
Triumph Electric Manufacturing Co., Ltd.
Vickers (France), Ltd.
World's Electric Co., Ltd.

Companies Struck off the Register.—The names of the undermentioned companies have been struck off the Register and they are thereby dissolved:—

Anode, Ltd.
Boulton Magnetos, Ltd.
British East African Power Development Co., Ltd.
Central Electric (Handsworth), Ltd.
Hightensite, Ltd.
Metallic Electrodes, Ltd.
Scott Electrical Co., Ltd.
Tredelect Dynamos, Ltd.

Yorkshire (West Riding) Electric Tramways Co., Ltd.—To a net income of £39,954 is added £8,219 brought forward, making £48,173. A dividend of 5 per cent. is paid on the ordinary shares; £19,452 is placed to renewals, depreciation and reserve fund; the reinstatement of roads consequent upon the abandonment of tramway routes requires £9,000; and £574 is carried forward. Unrestricted omnibus competition has led to the discontinuance of services on certain routes, and motor 'buses have been substituted. Meeting: to-day (Friday).

Bruce Peebles & Co., Ltd.—The directors recommend the payment of the following dividends in respect of the past year:—On the preference shares, a dividend at the rate of 7½ per cent. per annum, for the half-year ended December 31st, and a further dividend of 2½ per cent. per annum, for the year ended December 31st; on the ordinary shares a dividend for the year at 10 per cent. per annum, together with a bonus of 5 per cent.

Chas. Clifford & Son, Ltd.—There was a net profit of £20,873 for the past year, and the addition of the balance brought forward makes available £50,536. After paying the preference dividend and a total dividend of 10 per cent., and a bonus of 5 per cent., both free of tax, on the ordinary shares, £47,159 is carried forward.

Chelsea Electricity Supply Co., Ltd.—The ordinary shares are to receive a final dividend at the rate of 15 per cent., making 12 per cent. for the year, as in 1924. £17,000 is allocated to depreciation; £15,000 to reserve; and £9,000 is carried forward.

Clontarf and Hill of Howth Tramroad Co.—The general meeting of this company was recently held in Dublin, under the chairmanship of Dr. W. Lombard Murphy. The report and statement of accounts were adopted, and a dividend of 3 per cent. was declared.

Aberdeen Suburban Tramways Co.—The profit for the half year ended January 31st last was £188. With the addition of the sum brought forward there is a balance of £3,318 to the credit of profit and loss account. Meeting: To-day (Friday).

Crossley Bros., Ltd.—The net profit for 1925 was £60,383, and the addition of £19,075 brought forward, makes £79,458 available. The final dividend is paid on the preference shares, and a balance of £51,220 is carried forward.

Barcelona Traction, Light and Power Co., Ltd.—The directors have declared a dividend of 1¾ per cent. upon the 7 per cent. non-cumulative participating preference shares.

Newcastle-upon-Tyne Electric Supply Co., Ltd.—Final dividend on the ordinary shares, making 7 per cent. for the year, as in 1924.

Direct West India Cable Co., Ltd.—The directors have declared an interim dividend at the rate of 10 per cent., free of tax.

Shawinigan Water and Power Co.—A dividend of $2 per share on the common stock has been declared.

Halifax and Bermudas Cable Co., Ltd.—An interim dividend at the rate of 10 per cent., free of tax, has been declared.

Pennsylvania Water and Power Co.—A dividend of $2 per share has been declared for the quarter ending March 31st.

Stocks and Shares.

MONDAY EVENING.

THE London electricity supply companies have nearly finished the tale of their dividend declarations in respect of the second half of last year, and the distributions in every case have been maintained at those of the previous rates. That is to say, the dividends for 1925 are unaltered from those of 1924, in the London companies. This, while it has created a mild degree of disappointment among people who hoped that the companies would do something dramatic in the way of dividend declarations on the eve of the change-over, is a policy that is claimed as sound by others who contend that the companies are well-advised to strengthen their cash resources at a time like the present.

The effect upon prices of the dividend announcements has been actually nil. The factor that influences quotations at the moment is what is likely to happen when the reorganisations of capital are completed. Nor do all proprietors feel thoroughly happy at the outlook which confronts them, and which, as we have previously observed, is likely to be no worse, to say the least of it, than that which has prevailed during the past few years.

In the circumstances it is natural to look for dullness in the prices of electricity supply shares. St. James's, however, have risen ¼ to 16¼. Bromptons and Charing Cross are both 1/16 down. The rest of the London list is unchanged. Yorkshire Electrics at 29s. 6d. are quoted ex dividend. Midland Counties are 6d. higher at 24s. 3d. upon the company's report showing an increase in net profit of £18,800 to £142,000. The company has to pay this year on extra capital, but the dividend on the ordinary shares is maintained at 6 per cent., to which it was raised from 5¼ per cent. paid in 1923. The issued capital in the latter year was £1,723,519, whereas now it is within a few pounds of 2½ millions sterling. In all companies of this kind the tendency must be, of course, for the capital accounts to expand. As previously mentioned, the shares of these undertakings are in request by people who, recognising the inevitable growth of the concerns, recognise also the likelihood of new issues of shares being made at prices that will provide, in one manner or another, a bonus to the proprietors. The Electrical Distribution of Yorkshire pays its usual dividend of £7 tax free, and the net profit of £31,000 is £5,400 better than that of 1924. The Oxford Electric dividend of 7 per cent. is a rise of 1 per cent. over the previous year's rate. The shares stand at 5¼.

The Metropolitan Electric Supply Co. is promoting a Parliamentary Bill which, if carried in its entirety, will give the company extremely wide powers. The assumption is, however, that the company has gone "all out" for everything, in the hope of getting at least part of its proposals granted. Considerable opposition is set down against the Bill.

The feature in the Home Railway market is the rise to 100 in Underground Electric Income Bonds. These have been in speculative investment demand for some time past, and the rather disappointing results achieved by the Tubes, as shown by the reports out a week ago, have had no effect in stopping the absorption of these bonds, which are being picked up for American account as well as for local consumption. The company's £10 shares have recovered to 2¾, and Central London assented ordinary is a little better on balance at 68 x.d. London and Suburban Traction preference strengthened to 5s., London United Tramway debenture remains unchanged at 45.

The Traffic Committee, according to Sir Henry Maybury, is unanimously of opinion that tramways form an essential form of transport in London. His remedy for the present congestion lies in co-ordination of all traffic services, to which end he contends that resources should be pooled. It is with this idea in their mind that speculators have recently been buying London Tramway issues in a manner which is reflected in the prices of London and Suburban preference, and London United Tramway debenture.

A further remarkable rise has occurred in the price of Brazilian Tractions. The price touched 100 before it reacted to 99. Canadian buying is still declared to be the inspiration for the virility of the market, and as we have mentioned on many previous occasions, the Canadian-American interest is declared to be eager to obtain control through purchases of the shares. A curious, slightly humorous, rise occurred in Monterey "C" debenture, the price going from 1-3 to 2-6. Anglo-Argentine Tramways preferences of both classes are a little easier. British Columbia preferred strengthened a trifle.

Wireless shares continue dull, Marconis going back to 23s. 9d., and Radio common to 8¼. The latter company's preferred keep tolerably steady at 9¼. On the other hand, Marconi Marines are better at 18s. 9d. Burndept preferred rose from 13s. 9d. to 15s. bid. Cable stocks are inclined to strengthen, and amongst telephones, Automatics went back to 52s., after being 53s.; they show a small rise on balance.

Iron and steel shares show a fair degree of firmness, the outstanding feature being a rise of 1/16 to 53s. 9d. in Babcock and Wilcox. It is thought that the company is likely to benefit, not only from the Government's proposal to extend electrical development throughout the country, but also from the latest move guaranteeing capital for extension of the Kentish coalfield, in which Dorman Long and Pearsons are intimately interested. The cable equipment shares have moved but little. Speculation in these is subsiding noticeably. Brush and Metropolitan-Vickers ordinary are down to the common level of 27s.; on the other hand, Siemens strengthened to 31s. 3d. Telegraph Constructions maintain their rise at 29.

The London Power Co. achieved immediate success with an offer of three million pounds 5 per cent. redeemable debenture stock. This was eagerly snapped up at 96. The security, backed as it is by ten of the leading electricity supply companies in London, can be regarded as first-class, and the stock is gilt edged. The principal is repayable at par in 1972. The stock will take rank as one of the best of its kind in the eye of the cautious investor who wants permanency as well as safety for his capital.

Rubber shares are a dull and dispirited market, owing to the price of the raw product, which dipped to 2s. 4¾d. per lb. The slump has frightened some of the more nervous amongst rubber shareholders, and the fall in prices, from the best levels reached, is now substantial.

Share List of Electrical Companies.

HOME ELECTRICITY COMPANIES.

	Nom.	Dividend. 1923	Dividend. 1924.	Price Feb. 22, 1926.	Rise or fall.	Yield. p.c.
	£					
Bournemouth and Poole	1	13	14	63/3	—	4 8 7
Brompton Ordinary	1	10	10	1½	-1/16	*5 18 6
Charing Cross Ordinary	1	14½	15	45/9	-1/8	6 11 2
do. do. 4½ Pref.	1	4	4½	17/-	—	5 5 11
Chelsea	1	12	12	2½	—	5 12 11
City of London	1	15	15	47/-	—	6 7 8
do. do. 6% Pref.	1	6	6	23/-	—	5 4 4
Clyde Valley	1	8	8	30/-	—	5 6 8
County of London	1	15	15	£0/-	—	5 0 0
do. do. 6 % Pref.	1	6	6	22/6	—	5 6 8
Edmundson's Ordinary	1	7	7	24/-	—	5 16 8
do. 7% Pref.	1	6	7	22/6	—	6 4 8
Elec. Supply Corporation	1	10	10	32/6	—	6 3 0
Kensington Ordinary	5	14	15	14½	—	5 5 3
Lancs. Light and Power	1	7½	7½	27/-	—	5 11 1
London Electric	1	10	10	32/-	—	6 5 0
do. do. 6% Pref.	5	6	6	5/-	—	5 7 10
Metropolitan	1	10	11	39/6	—	5 11 2
do. 4½% Pref.	1	4½	4½	17/6	—	5 2 10
Midland Counties	1	5½	6	24/3	+6d.	4 19 0
Newcastle-on-Tyne Ordinary	1	6	7	23/9	—	5 17 11
do. 5% Pref.	1	5	5	18/9	—	5 6 8
do. 7% Pref.	1	7	7	24/6	—	5 14 8
Notting Hill 6% Pref.	10	C	6	9½	—	6 6 4
North Met. Elec. 6% Pref.	1	6	6	22/6	—	5 6 8
St. James' and Pall Mall	5	17½	17½	16¼	+¼	5 7 8
South London	1	15	15	2	—	5 17 1
South Metropolitan Pref.	1	7	7	1	—	5 6 8
Urban Ordinary	1	4	4	19/6	—	4
do. 6% Pref.	1	6	6	1	—	6 0
Westminster Ordinary	1	15	15	46/3	—	6 9 6
Whitehall Elec. Invst. 7½% Pref.	1	7½	7½	1	—	7 10 0
Yorkshire Elec.	1	8	8	29/6xd.	—	5 8 6

HOME RAILS.

Central London Ord. Assented	Stock	4	4	68xd.	+½	5 17 8
Metropolitan	,,	4	5	68½	—	7 6 0
do. District	,,	3½	3½	47½	—	7 7 4
Underground Electric Ordinary	10	Nil	Nil	2¾	+¼	Nil
do. do. "A"	1/-	Nil	Nil	7/8	—	Nil
do. do. Income	Bonds	6	6	100	+1	*6 0 0

TELEGRAPHS AND TELEPHONES.

Anglo-Am. Tel. Pref.	Stock	6	6	102	—	5 17 8
do. Def.	,,	1½	1½	28¾	—	6 6 4
Automatic Telephone	1	3	6	52/-	+9d.	2 6 2
Chili Telephone	5	6	5	6½	+1/8	*3 16 11
Cuba Sub. Ord.	10	5	5	6¾	—	7 8 2
Eastern Extension	10	10	10	18	—	*5 11 1
Eastern Tel. Ord.	Stock	10	10	177½	+1	*5 12 8
Globe Tel. and T. Ord.	10	10	10	18¾	—	*5 9 7
do. do. Pref.	10	6	6	11	—	5 8 4
Great Northern Tel.	10	22	22	32	—	6 17 6
Indo-European	25	7	8½	45½	—	*4 13 5
Marconi		10	10	23/9	—1/8	8 8 6
Marconi Marine	1	10	7½	18/9	+1/8	8 0 0
Oriental Telephone Ord.	1	12	12	2¾	—	*5 12 11
United R. Plate Tel.	5	8	8	7¼	+1/8	5 1 7
Western Telegraph	10	10	10	17¾	—	*5 11 11

HOME AND FOREIGN TRAMS, &c.

Anglo-Arg. Trams First Pref.	5	5½	5½	3	—1/8	8 12 6
do. do. 2nd Pref.	5	6	6	3	—1/8	9 16 0
do. do. 5% Deb.	Stock	5	5	73½	—	6 16 3
British Electric Traction Ord.	,,	6	6	117½	—	5 2 2
do. do. 6% Pref.	,,	6	6	106	—	5 13 2
Brazil Traction	100	4	4	99	+6	4 5 1
Brit. Columbia Elec. Rly. Pos.	Stock	5	5	84½	—	5 18 4
do. do. Preferred	,,	96/-	96/-	104	+½	*4 12 4
do. do. Deferred	,,	129/5	129/5	128	—	*5 1 7
do. do. Deb.	,,	4¼	4¼	79	—	5 7 7
London & Sub. Trac. 5% Pref.	1	2½	Nil	5/-	+6d.	Nil
London United Tram. Deb.	Stock	4	4	45	—	8 17 10
Mexico Trams, 5% Bonds	—	5	5	62½	—	8 0 0
Mexican Light Common	100	Nil	Nil	32½	—	Nil
do. Pref.	100	Nil	Nil	64½	—	Nil
do. 1st Bonds	—	5	5	69½	—	7 3 11
Yorkshire (West Riding)	1	5	—	16/3	—1/3	6 3 1

MANUFACTURING COMPANIES.

Babcock & Wilcox	1	12	12	2	+1/16	*4 9 5
British Aluminium Ord.	1	5	10	38/9	—	5 0 2
British Elec. Transformer Pref.	1	Nil	7	20/9	—	6 14 11
British Insulated Ord.	1	15	15	3	—1/8	5 0 0
Brush Ord.	1	10	10	27/6	—6d.	7 5 6
Callenders	1	15	15	3½	—	4 5 9
do. 6½% Pref.	1	6½	6½	22/6	—	5 15 7
Crompton Ord.	1	Nil	Nil	16/9	—	... ...
Edison-Swan	4/-	10	10	9/-	—	4 8 11
do. 5% Deb.	Stock	5	5	83	—	6 0 6
Electric Construction	1	10	10	33/9	—	5 18 6
Enfield Cable, Pref.	1	7½	7½	1½	—	6 0 0
English Electric	1	5	5	20/3	—	4 18 9
do. do. Pref.	1	6	6	30/6	—	5 17 1
Gen. Elec. Pref.	1	6½	6½	24/-	—	5 8 4
,, Ord.	1	5	7½	31/6	—	4 15 3
Henley	1	15	16	3	—	4 8 3
do. 4½% Pref.	5	4½	4½	4¼	—	5 6 0
India-Rubber	1	5	5	1½	—	*4 0 0
Johnson & Phillips	1	10	10	21½	—	3 8 3
Met.-Vickers, Ord.	1	8	8	27/-	—6d.	5 18 6
do. Pref.	2	8	8	2	—	6 14 9
Siemens Ord.	1	—	7½	31/3	+1/3	4 16 0
Telegraph Construction	12	20	10	29	+½	*4 2 9

*Dividends paid free of Income Tax.

Exports and Imports of Electrical Goods and Machinery in January, 1926.

THE export figures for January are not encouraging; there was a decline of £84,086 as compared with the previous month, while comparison with the corresponding period of last year shows a fall of £364,209. The decline from the December, 1924, total (£84,086) was mainly due to the decreased exports of unenumerated electrical machinery, while submarine telegraph and telephone cable also contributed to a large extent. The increases were greater in number but failed to compenstate for the fall in these two items. The seriousness of the decrease of over £364,000 from the January, 1924, figure is somewhat mitigated by the fact that £259,193 of it was due to a fall in the value of submarine cable exports; this, as we have previously observed, is an item subject to very violent fluctuations, rendering comparisons very difficult and often misleading. Apart from this, however, the decline was certainly a large one—in the neighbourhood of £100,000—and was attributable mainly to the decreased shipments of motors and generators and telegraph and telephone instruments and apparatus.

The fall in the import total, while numerically smaller than in the case of the exports, was proportionally larger, and was, moreover, a general decrease. Only three items rose, the principal increase occurring in telegraph and telephone wires and cable (not submarine). The most noticeable decline occurred in the item "batteries and accumulators," which, by the way, was accompanied by a rise in the exports of these articles. The fall in the imports of insulated wires and cables was also attended by a rise in the export section. In comparison with January, 1924, imports were down by £70,729, telegraph and telephone apparatus and batteries and accumulators being mainly responsible for this. There was a substantial increase in the importation of unenumerated electrical goods.

As compared with the preceding month, re-exports were uninteresting, but the total represented only two-thirds of that of January, 1924. The decrease was well distributed; only glow lamps and batteries and accumulators showed a rise.

	Exports.			Imports.			Re-Exports.		
	Electrical exports for Jan., 1926.	Inc. or dec. as compared with Dec., 1925.	Inc. or dec. as compared with Jan., 1925.	Electrical imports for Jan., 1926.	Inc. or dec. as compared with Dec., 1925.	Inc. or dec. as compared with Jan., 1925.	Electrical re-exports for Jan., 1926.	Inc. or dec. as compared with Dec., 1925.	Inc. or dec. as compared with Jan., 1925.
Electrical goods and apparatus (unenumerated)	£167,811	+ £11,335	+ £11,488	£125,374	— £5,451	+ £21,923	£6,980	+ £1,338	— £3,883
Insulated wires and cables ...	268,560	+ 15,146	+ 31,747	47,693	— 26,466	— 7,560	237	— 424	— 776
Glow lamps	42,381	+ 2,092	— 1,341	44,606	+ 7,665	+ 8,430	2,261	+ 1,836	+ 2,034
Arc lamps and parts	2,187	+ 1,184	+ 1,947	330	— 1,188	— 1,109	2	— 10	— 151
Batteries and accumulators ...	85,806	+ 10,669	+ 8,654	24,556	— 25,972	— 43,088	1,274	+ 730	+ 750
Meters and instruments ...	22,300	— 5,928	+ 4,645	20,395	— 2,372	+ 411	728	— 971	— 2,059
Carbons	2,499	+ 1,379	— 1,581	4,268	— 4,994	— 3,339	106	— 348	— 99
Electrical Machinery—									
Electrical machinery (unenumerated)	224,318	— 76,717	— 15,974	84,198	— 18,108	+ 20,219	5,764	— 2,041	— 946
Railway and tramway motors	45,405	— 345	— 26,751	—	—	—	—	—	—
Other motors and generators ...	203,847	+ 6,214	— 54,983	—	—	—	—	—	—
Switchboards (not telegraph or telephone)	4,929	— 4,171	— 2,361	257	+ 32	+ 182	—	— 30	— 924
Telegraph and Telephone Cable and Material—									
Telegraph and telephone wires and cable (not submarine)	68,590	+ 5,796	— 15,624	34,664	+ 20,099	+ 18,061	17	— 47	— 89
Submarine telegraph and telephone cable	14,323	— 43,914	— 259,193	—	—	—	—	—	—
Telegraph and telephone instruments and apparatus ...	210,370	— 6,826	— 44,882	50,853	— 20,083	— 77,859	4,438	— 974	— 4,710
Totals	£1,363,326	— £84,086	— £364,209	£437,194	— £76,838	— £70,729	£21,807	— £941	— £10,852

An Extra-High-Pressure Cable.

Some Constructional Details and Test Results of the New Pirelli Cable.

THE rapid growth in the demand for electrical energy, and the concentration of generating plant in large power stations, has made the use of very high-pressure transmission lines a necessity. Hitherto, transmission at 11,000 and 22,000 volts has answered the purpose; 33,000 volts has now become standard practice, and many miles of underground cable are working satisfactorily at this pressure. It is, however, not sufficient for the transmission engineer, who sometimes requires voltages very much higher for his purpose; and in consequence pressures above 35,000 volts have had to be dealt with by overhead lines. The dangers and objections which beset overhead transmission, however, are many, but for the time being there is little or no alternative. The problems which confront cable makers in competing with overhead work are difficult, and considerable amounts of time and money are being spent in research work to develop cables of suitable design and construction to meet the situation. In the meantime the developments in connection with the new e.h.p. cable, made by Messrs. Pirelli, Milan, are being closely watched, and it is interesting to learn that the makers have built and installed underground cables which have been operating successfully for a considerable time on 3-phase systems, at pressures higher than 35,000 V. In Barcelona 6¼ km of cable (19.5 km. of single core) is working at 50,000 volts, between phases. In the Gothard Tunnel, power at 60,000 volts single phase is carried over 22 miles of cable; and, as reported by Mr. Emanueli, at the "Conference Internationale des Grands Reseaux Electriques" in Paris, an experimental line of three single-core cables, each 600 metres long, has been laid in conjunction with an overhead line, and has been operating at 130,000 volts without interruption for the past two years. This cable was briefly described in the ELECTRICAL REVIEW, May 1st, 1925, and we have received from Messrs. Pirelli-General some further particulars concerning its construction.

There are several novel features in the design of this cable, many of which are covered by patent rights, and in some cases the processes used are not available for publication. The conductor is made hollow, as shown in fig. 1 (full size), and the necessary number of copper wires are laid up on the outer surface of a galvanised iron or h.d. copper spiral, which provides sufficient support to maintain the tubular formation, and at the same time, being elastic, is able to accommodate itself to movements due to handling.

The insulation is of paper and is applied in the usual manner, but it is graded, according to its permeability, so as to present a dielectric strength proportional to the pressure gradient at all points from the conductor to the lead covering. Graded paper insulation, as regards thickness of paper, has been used by manufacturers for some years past, but in 1919 Mr. Emanueli discovered that a relation existed between the porosity of the paper and its dielectric strength. Graduation, therefore, is determined not by the thickness of the paper, but by the degree of its permeability to fluid. This quality

is measured by means of a suitable apparatus, in which the paper to be tested is traversed under a certain pressure P by a fluid, which may be air, and then, by measuring the time t, required for a determined volume s of the fluid in question to penetrate the thickness of the paper, a coefficient A, strictly related to the permeability, can be obtained by a suitable manipulation of the quantities t, s and P, together with the coefficient of viscosity n of the fluid, $A = f(t, s, P, n)$.

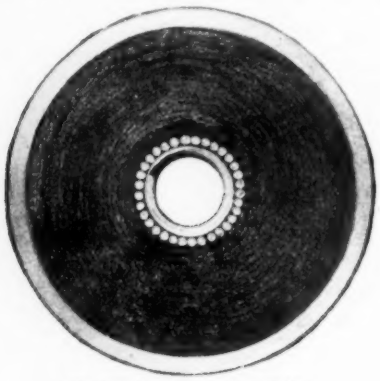

Fig. 1.—Section of e.h.p. Cable.

The dielectric strength may be determined by any of the well-known means.

The principal conclusion drawn from researches made in this direction is that, the impregnating compound being constant, the dielectric strength is, up to a certain point, greatest in the least permeable paper. For example, a paper of A = 50,000 dried and impregnated is perforated at 15,000 volts/mm., whereas a paper of A=370,000, similarly treated, requires a pressure of 37,000 volts/mm., before it can be perforated. However, no further increase of dielectric strength is obtained with papers of a higher A (see fig. 2). In order, therefore, to obtain a high resistance to perforation in cables for conveying very high-pressure electrical energy it would be necessary to use only paper possessing a very high degree of impermeability, or at least not below a certain limit (A = 400,000).

Layers of highly impervious paper (50 kV/mm.) are applied next to the conductor—and it would appear to be an extremely simple matter to build very high-pressure cables by continuing the use of this paper throughout, but practical difficulties arise, as the density of this paper prevents the thorough impregnation of the core, consequently successive outer layers are composed of papers of gradually decreasing density—that next to the lead having a dielectric strength of 30 kV/mm. The highest stresses are, therefore, met by the insulation of greatest density, and the lower stresses by insulation of corresponding lesser densities. In this way highly efficient insulation is obtained, and the over-all diameter of the cable reduced, without, however, in any way reducing its factor of safety. The very unusual practice is adopted of lead-covering this type of cable before, instead of after, drying and impregnating. Dry air is passed through the hollow centre, and by application of electrical tests the process of drying is watched throughout, and the required result obtained with certainty. Impregnation also takes place from the centre of the cable, to which a vacuum is directly applied. Better results are found to be secured by producing, within the cable itself, a higher degree of vacuum than can be obtained when employing the usual method of tank impregnation.

In the installation of this cable the central cavity is maintained through the joints. At the terminal ends and intermediate points it is connected with tanks placed at suitable heights, and the whole is filled with a light insulating oil. By this means oil is kept in the hollow core under pressure and in immediate contact with the insulation throughout the whole length of the cable, and expansion and contraction of the oil, due to temperature rise or fall, is accommodated in the reservoirs.

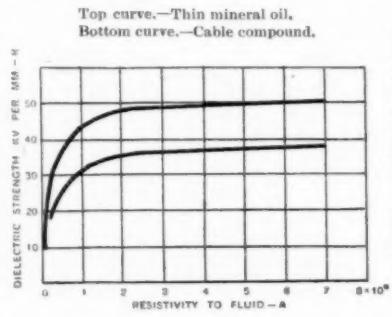

Fig. 2.—Dielectric Strength and Resistivity.

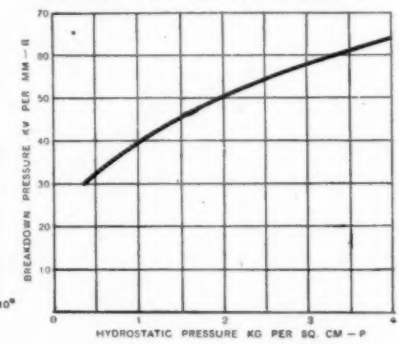

Fig. 3.—Dielectric Strength and Fluid Pressure.

It is interesting to note the effect of increasing the pressure on the dielectric strength of the cable paper impregnated with this thin oil. Fig. 3 shows that an increase of pressure from 1 to 4 kg./cm.^{2} is sufficient to double the breakdown voltage.

This design overcomes many of the difficulties that are met with in the usual form of cable; the use of three separate lead-covered cores eliminates the dangers set up by tangential stresses which assume serious proportions in very high-pressure 3-phase cables. The hollow construction, and the use of the thin oil, ensure that the cable is full of oil at all conditions of load; the expansion tanks supply oil when required, or receive excess oil and store it, to suit the changing conditions. Thus no voids or gas spaces are formed in the cable, and no deterioration takes place.

The joints are made by using a copper tube, upon which the conductor wires are laid and soldered, thus maintaining the tubular passage. The insulation of the cable, having been tapered down from the lead to the conductor (the tapered portion extending over a considerable length on both sides of the joint), is built up with strips of impregnated paper. Here, as at the terminals, the perfect impregnation which is obtained, due to the hollow design, considerably assists in eliminating the serious disadvantages which arise from the presence of gas pockets; consequently the over-all diameter of the joint is little more than that of the cable itself. To prevent the joint absorbing moisture whilst the insulating tape is being applied, hot dry air is blown on the joint during the whole of the process. The joint is then impregnated, and to ensure this being thoroughly done, a vacuum is produced in the hollow centre of the cable, and sufficient current passed through the conductor to warm up the cable, and to make the compound more fluid to penetrate the insulation and to drive out all traces of humidity. The insulation over the joint is then covered with metal foil, contact being made with the lead sheath on both sides, in order that the stresses due to the sheathing may be continued, without interruption, throughout the length of the cable. At the terminals the lead sheath is bell-mouthed to a specified shape, so that the stresses parallel with the paper insulation are constant from the point where the sheath ceases to be in contact with the insulation to that where the insulating material increases in thickness.

These cables are laid direct in a trench, approximately 30 in. deep by 20 in. wide. They are, of course, unarmoured, but the lead sheaths are protected by layers of suitable waterproofing material. They are laid with 6 in. between centres, separated from each other by a line of bricks, and protected by brick covers. All the sections constituting the line in Italy were tested before leaving the works, with 150,000 volts for 15 minutes, then with 175,000 volts and 200,000 volts for one minute. A short length was tested with 275,000 volts for two minutes, and then 150,000 volts for 24 hours, without sign of hot spots. When the cable was laid, jointed and connected to its special terminal ends, the system was tested up to 180,000 volts, 3-phase, this being the highest available pressure. Dielectric loss/voltage (fig. 4) and dielectric loss/temperature curves (fig. 5) show the remarkably good results obtained with this method of construction.

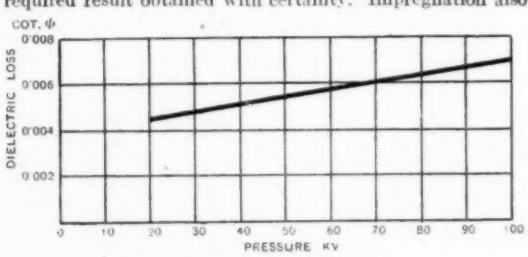

Fig. 4.—Dielectric Loss and Pressure.

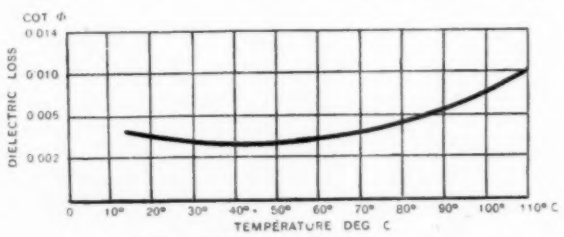

Fig. 5.—Dielectric Loss and Temperature.

It will be recalled that a special design of pothead is used for terminating this cable, and the construction of it was described and illustrated in the issue of the ELECTRICAL REVIEW already referred to.

It is interesting to note that the N.Y. Edison Co. has ordered a cable of the above type for 132,000-V transmission, and that a similar cable for 140,000-V working is to be supplied to Chicago.

The London Telephone Service.

Developments and Progress during the Year 1925.

A STATEMENT of progress in 1925, signed by Mr. W. A. Valentine, controller of the London telephone service, and Mr. R. McIlroy, superintending engineer of the London Engineering District, shows that the London telephone area covers approximately 750 sq. miles, and extends from Reigate in the south to Waltham Cross in the north, and from Tilbury in the east to Hayes in the west. The requirements of this area are at present met by 107 exchanges, including the trunk (long-distance) exchange, which handles traffic to the more distant provincial exchanges, the Irish Free State, and the Continent, and the toll exchange, which deals with traffic to the nearer provincial exchanges. They vary in size from 100 to 10,000 lines, and the number of exchange lines connected at the end of 1924 was 244,342; at the end of 1925 the net increase was 25,459, or about 10.4 per cent.

There is an increasing demand for private wires; the increase during the year was 1,200, and the total number is now 15,000. The total number of telephones (exchange and private) at the end of 1925 was 476,813, a net increase of 37,590. Private branch exchanges (p.b.x.) total 21,000; of this number, 62 are automatic. At the request of subscribers, approximately 28,000 removals and alteration of apparatus were effected. Call offices working at the end of 1925 numbered 4,403, the increase for the year being 260. Kiosks, at which a day and night service is provided in the streets, numbered 212. Multi-coin boxes for call offices, which permit the use of shillings and sixpences for long-distance calls, as well as pence for short-distance calls, meet the public need, and extensive development is contemplated.

Four new exchanges were opened to serve new areas, Albert Dock, Franklin, Mill Hill, and Sloane, providing an increased capacity of 5,600 lines. Six new exchanges were provided to replace exchanges already existing at Enfield, Grangewood (formerly East Ham), Malden, Palmer's Green, Pinner, and Tilbury; in addition, the equipment of 47 existing exchanges was extended and provide (with the new exchanges mentioned) additional capacity of approximately 24,000 lines. Work in hand includes ten new exchanges and the extension of 27 existing exchanges, to provide increased capacity of 36,440 lines; new exchanges and extensions projected for the present year will provide a further 30,000 lines. If the anticipated rate of telephone growth is maintained, it will be necessary during the next eight years to open 71 automatic exchanges within 10 miles from Oxford Circus and 33 manual exchanges outside that radius, but within the London Telephone area, which will provide for the replacement of worn-out plant as well as for growth.

During the past year an extension of the toll exchange was completed, increasing its capacity by 25 per cent. A new toll exchange of approximately twice the capacity of the present exchange, and designed to work in conjunction with it, is expected to be completed in 1926. New underground cable has been provided between London and Glasgow, and five new direct lines have been brought into use between these cities. Work has commenced on additional cables to carry trunk and toll circuits from London to Farningham, Tonbridge, Sutton, Stanmore, Leatherhead, Cambridge, and Derby, most of which cables have been brought into use. There are 14 new exchange buildings under construction, and sites for 21 additional exchanges have been secured, but considerable difficulty is experienced in acquiring sites for exchanges in suitable situations.

There has been a rapid increase of line plant during the year: The total mileage of single wire provided for subscribers' lines and local junctions is now 1,800,000, an increase during the year of 131,000 miles; the total mileage on December 1st, 1918, was 1,100,000. The great majority are underground, of which there are 7,000 miles, each cable containing from 20 to 2,000 wires; the weight of copper in these cables is over 10,000 tons, and 40,000 tons of lead has been used to sheath them. Earthenware ducts and iron pipes increased during the year by 693 miles to 6,450 miles. The total length of pole line in London is 5,280 miles, and the mileage of single wire carried on them is 63,294. The amount of "open" wire shows a tendency to decrease, as the increasing telephone density in some areas renders it economical to use underground cables. In some of the more important streets in the City area it has been necessary to resort to tunnelling. The automatic installations in hand represent a capacity of about 45,000 lines, and those projected about 147,000 lines—about 192,000 lines in all in the section of the automatic programme which has been commenced. Progress has been made with the "tandem" exchange, the purpose of which is to facilitate calls to and from subscribers connected to exchanges between which there is not sufficient traffic to justify the provision of direct groups of junctions; about 8,800 junction lines will be connected to the tanden exchange.

During the year the largest private automatic branch exchange in the country (that serving the Port of London Authority and its various sub-departments) was opened. Automatic exchanges have also been provided at the following docks:—London and St. Katherine, India and Millwall, Victoria and Albert, Surrey Commercial, and Tilbury; the initial equipment caters for 740 extensions, but provision has been made for extension to 1,370 ultimately. During 1925 orders were taken for 26 private automatic branch exchanges, as compared with a total of 52 such orders in the preceding three years.

At present London subscribers originate, on the average, 1,667,000 calls per working day, or about 478,600,000 calls per year, an increase of about 7.5 per cent. as compared with the previous year; of the average daily traffic, about 256,000 calls are made during the busy hour of the morning, so that about 15 per cent. of the 24 hours' traffic is handled in a single hour. Day and night service is given at all exchanges, and on the average about 61,000 calls are originated daily between 8 p.m. and 8 a.m. About 80 per cent. of the total calls originated are made to subscribers on other exchanges, and to accommodate this inter-exchange traffic over 29,000 junction lines have been provided, an increase of about 9 per cent. on last year's total. The number of calls outgoing from London daily at the trunk and toll exchanges is about 26,500, an increase of about 7.2 per cent. over the preceding 12 months.

For the Anglo-Continental traffic, additional lines have been provided to Amsterdam and Rotterdam, and the traffic has risen appreciably. The service is available between all British and Dutch exchanges; there is also direct service to Antwerp, Brussels, and Ostend open to all Belgian towns. Taking the Continental traffic as a whole, 50 per cent. is to France, 24 per cent. to Holland, 21 per cent. to Belgium, and 5 per cent. to Switzerland.

The Phonogram room at the Central Telegraph Office, for the reception and transmission of telegraph messages direct from and to telephone subscribers, has 380 junction circuits to 68 telephone exchanges in the London area, while facilities have been provided for the employment of 220 telephonists to receive and transmit telegraph messages, and an extension to accommodate an additional staff of 72 is now in hand. The number of phonograms dealt with during 1925 was 1,423,781, the increase being about 12.3 per cent. From the public point of view the phonogram service is rapidly increasing in attractiveness. On Christmas Eve no fewer than 19,000 telegrams were forwarded and received by telephone.

The operating staff employed in the exchanges of the London telephone service numbers about 8,200 telephonists and supervisors. Over 1,200 new entrants to the service passed through the Clerkenwell operating school during the year and, in addition, seventy telephonists employed by subscribers for their private branch exchange work were trained in standard methods of operating. Eight telephone officials from other countries visited the school to study the methods employed in training the staff. Over 70,000 engineering workmen are employed, about two-thirds of them on construction and development work and the remainder on maintenance.

The operating of over 100,000 calls was observed, and statistics indicate that the average time of answer to the subscribers' calling signals for the year was 5.4 seconds, 89.4 per cent. of the calls being answered within 10 seconds, or less. Complaints from subscribers regarding local call charges are decreasing. The electrophone exchange was closed on June 30th, 1925. The number of subscribers reached 2,080 in January, 1923, but the introduction of wireless broadcasting resulted in a gradual diminution. At the G.P.O. South, apparatus is to be used for amplifying speech received over long trunk lines, and a set already installed has given satisfactory results. The introduction of this apparatus will appreciably extend the range of speech, as the attenuation due to the use of long lines can be corrected by means of valve amplifiers.

The City Smoke Problem.—In an address delivered before the Circle of Scientific, Technical and Trade Journalists, on February 16th, Dr. John S. Owens, B.A., A.M.Inst.C.E., pointed out that the pollution of the air by smoke resulting from the growth in size of cities had grown so gradually that the magnitude of the evil was not fully recognised. He divided the problem of obtaining clean air into two parts: First, the production of an active desire on the part of the community to keep the air clean; without this, the second, or technical, part of the problem, namely, the finding of the means, would not be likely to be solved. The smoke problem was essentially a public one; the evil effects were rarely felt by the smoke producer himself, but by his neighbours. The contrast between the care taken to keep water and food supplies pure and unpolluted and the little attention given to the provision of pure air was indicated; the economic cost to the country was also mentioned, and it was stated that smoke cost, in London, about 24s. per head of the population per annum, when all its effects were taken into account. In Manchester the cost was about 30s. per head, and in other cities it was doubtless much higher. There was thus a colossal waste which was largely avoidable. The keynote of Dr. Owen's address was the part the Press had to play in bringing about improvement, by removing the public apathy and producing a desire for such improvement, without which there would be little progress.

The Electric Propulsion of Ships.

Some Details of the Equipment of a 17,000-h.p. Twin-screw Liner.

(Abstract of Paper read before the NORTH-EAST COAST INSTITUTION OF ENGINEERS AND SHIPBUILDERS.)

AT a well-attended meeting of the N.E. Coast Institution at Newcastle-on-Tyne recently a paper on the above-named subject was read by Mr. W. J. Belsey (of the British Thomson-Houston Co., Ltd.), in the absence of its author (Mr. Eskil Berg, of the General Electric Co., of America). Sir William J. Noble, past president, occupied the chair, and the reading of the paper, which is abstracted below, was followed by a discussion.

The paper contends that the electric propulsion of ships can no longer be considered in the experimental stage. Its use by the United States Navy during the last ten years, and its application to a few rather large cargo steamers as well as several other types of ships, have proved this method successful, reliable, economical, and the upkeep of the electrical apparatus has been practically nil.

For large powers where steam is considered, the steam turbine must be used on account of its high efficiency, as compared with any other steam prime mover; in order to obtain the best efficiency, the machine must be designed for relatively high speed (r.p.m.), which makes it necessary to interpose either mechanical speed reduction or electrical transmission between the turbine and propeller shafts. Mechanical gears for large powers require a multitude of turbines and pinions, complicated steam piping and cross-over connections between the various turbines, as well as a multitude of turbine gland packings. Reversing turbines are a source of great loss, not only friction loss, but, as they necessarily make the turbine longer (which makes the distance between bearings greater) a larger diameter shaft for the same deflection is involved, thus increasing the packing losses as well as bearing losses. With mechanical gears, the turbines adopted have generally to be of lower speed (r.p.m.) than that which would give the most economical design for the horse-power required. This item is important, as, in almost every case, the lower-speed turbine with the features mentioned above will involve a loss in turbine economy that is a great deal more than the total electrical transmission loss; in some cases, it may be more than double the electrical losses.

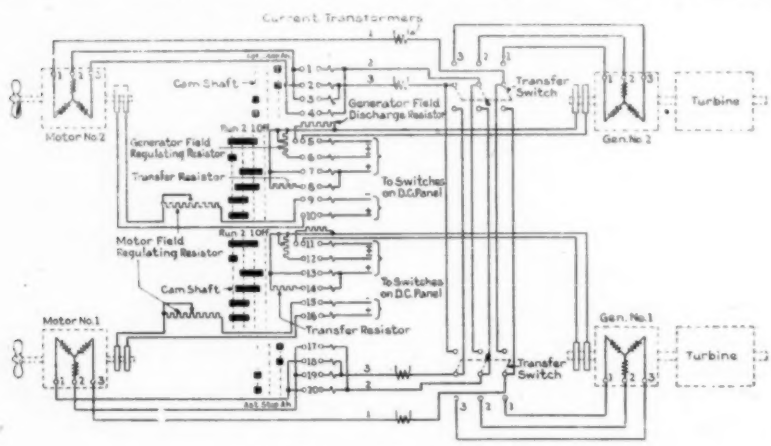

Fig. 1.—Diagram of Electrical Connections.

In electric ships full advantage can always be taken of new improvements in turbine design which develop in the enormous field of turbo-generators for central station use; in other words, the very latest turbine designs can always be used. The enormous advantage in economy by the use of high steam pressure, steam temperature, steam extraction for heating boiler feed water, &c., can be secured in the electric ship without any complication and with practically no special divergence from standard modern steam station practice. Many stations are successfully using 550 lb. boiler pressure and a steam temperature of 725 deg., which produce 1 kWh at the switchboard with about one pound of coal of 14,500 B.th.u. This is not a record of a few hours' operation, but is a weekly record, and includes the whole power plant, taking into consideration load factor, cleaning boilers, &c. What this means on board ship may be illustrated by the fact that a large luxurious liner using 50,000 h.p. can be operated with a total fuel consumption of less than 300 tons of fuel oil per day, including everything on board the ship.

Recently the International Mercantile Marine has closed a contract with the Newport News Shipbuilding Co. for an electrically-driven, twin-screw, passenger-cargo liner having 17,000 h.p. The propelling machinery is to be built by the General Electric Co. of the United States of America, and the dimensions and particulars of the ships will be as follows:—Length, 600 ft.; beam, 80 ft.; draught, 30 ft.; displacement, 22,000 tons; propeller speed, 120 r.p.m.; horse-power, 17,000; speed, 18 knots; propellers, 18 ft. 6 in. in diameter, 17 ft. 3 in. pitch. The steam pressure at the throttle will be 250 lb.; superheat at throttle, 100 deg. F.; vacuum, 28½ in. The 12 Babcock & Wilcox oil-burning marine boilers will have each 4,600 sq. ft. of heating surface and 1,344 sq. ft. of superheating surface. The two turbine-driven alternating-current generators will have a rating of ATB 2—6,600 kW, 2,888 r.p.m., 4,000 volts. The two main synchronous induction motors for direct connection to the propeller shafts will have a rating ATI 48—6,600 kW, 120 r.p.m., 4,000 volts. There will also be four 500-kW direct-current generating sets.

In this case no attempt has been made to reduce the weight of the apparatus from that used for land purposes:—

The weight of the two turbo-generators, including all accessories, tools, &c., will be ...	306,000 lb.
The two main propelling motors will weigh ...	338,000 lb.
Complete control equipment, including cables	17,000 lb.
Total ...	661,000 lb.

Weight per shaft horse-power, 39 lb.

Electric propelling machinery has also been laid out for a light cruiser having 120,000 h.p. In this case the weight is of the greatest importance and the equipment would weigh 18 lb. per shaft horse-power.

The price of the electrical propelling equipment complete in this case is substantially the same as the geared-turbine equipment proposed for this ship, but on account of simplier and less costly foundations, piping, oiling system, &c., it was found to be cheaper than any other method of propulsion proposed.

The control apparatus will consist of contactors for closing the electrical circuits between the generators and motors; it will be operated by means of four levers (two for each motor). In addition, there will be two small levers for regulating the speed of the main turbines. The two main levers for each propulsion motor will consist of: One for regulation the excitation of the generator and the motor; the other is the reversing lever, which will have three positions, "ahead," stop," "astern." The field lever will have four definite positions, "off," "1," "2," "Run." On position "1" double excitation will be applied to the generator alone; in this position, with the reverse lever on either "ahead" or "astern," the propelling motor will be started or reversed as a pure squirrel-cage induction motor. In position "2" normal excitation will be applied to the rotor field, leaving double excitation on the generator; in this position the motor will phase in and become a synchronous motor. Position "run" reduces the excitation of the generator to normal.

Speed variation of the propeller revolutions in either direction will be obtained by varying the turbine speed, controlled by the operator from the small lever on the control board. Normally both turbo-generators will be in operation. Should, however, it be desired at any time to operate the ship at three-fourths speed (or lower) for a considerable length of time, only one generating unit need be used and both propelling motors can be operated from the control board exactly in the same way as when both units are running. This feature should prove most economical should the ship be used for cruises during the slack season, as in this case almost 15 knots can be obtained.

The motors and the generators are designed to give the necessary torque to reverse the propellers from 120 r.p.m. ahead to 120 astern in 20 seconds; quicker reversal can be had, but is not considered advisable. Fig. 1 is a diagram of connections of the electrical circuits and fig. 2 shows the arrangement of the machinery in the ship, but is subject to slight changes at the present time.

The steam consumption per s.h.p. delivered to the propeller shaft (including all losses in generators, motors, cables, &c.), will be 9.5 lb. when delivering 17,000 h.p. to the propeller shaft at 120 r.p.m.; when delivering 13,500 h.p. at 110 r.p.m. under the same steam conditions the consumption will be 9.9 lb., and considerable margin is included in these figures to take care of sea conditions and inaccuracy of tests. If electrically-driven auxiliaries are used, the fuel consumption per s.h.p. hour, including everything on the ship, at 17,000 h.p., will be 0.85 lb., and at 13,500 h.p. 0.90 lb.; in these calculations slightly over 1,000 kW direct-current load has been assumed in both cases. This ship will be operated with only 100 deg. F. superheat. The design of the turbine is, however, made to use efficiently and safely 300 deg. should it at a later date be desired to increase the superheat, or if new additional ships

should be built. The fuel saving by going to 200 deg. over 100 deg. is 5 per cent. and to 300 deg. over 100 deg. is 9 per cent. Electric propulsion is particularly well adapted to high steam temperatures, as all the reversing is done electrically and no undue heat stresses, or temperature changes, take place in the turbine itself—as is the case when mechanical gears are used.

At 17,000 h.p. load and 120 r.p.m. of the propellers, the generator will have an efficiency of 96.75 per cent., excluding excitation which, in this case, will be 32 kilowatts per generator, or less than ¼ per cent. The motors will have an efficiency of 97.5 per cent., excluding excitation, which amounts to 45 kW per motor, or 0.68 per cent. The loss in cables and control will amount to 0.04 per cent. The total transmission loss will be, therefore, excluding excitation, about 5.7 per cent., or, if excitation is included about 6.75 per cent.

At reduced speed of the vessel the efficiency of the generator and motors will remain practically constant, as the voltage is then reduced in about the proportion of the square root of the horse-power, so that at three-quarters speed the voltage is reduced from 4,000 to about 3,000 volts, and the transmission loss is only increased from 6.75 per cent. to 7.4 per cent., although the load is reduced from 17,000 h.p. to about 7,000 h.p. The loss in gear efficiency, under similar conditions, would be about 2 per cent.

The advantages of electrically driving a large liner are simple means of speed reduction between the turbine and propeller in almost any ratio which may be desired. It affords means of reversal by simple change of electrical connections, without changing the direction of rotation of the turbine. Any desired reversing torque up to the full power of the turbine can be obtained without affecting the efficiency of the equipment in the forward direction. Reversal is obtained with a minimum amount of steam drawn from the boilers, as the full inertia of the turbo-generator is first used in the act of reversal; in fact, in most cases actual reversal is obtained without drawing any steam from the boilers, and steam is only used from the boilers to accelerate the propeller speed in reverse rotation. Electrically-driven vessels can be made noiseless.

Electric drive makes it possible to obtain accurate data, either by instantaneous readings, or by recording instruments, of the load on the propeller shaft under various conditions of sea and wind; to have a real check between fuel consumption and horse-power-hours developed means a constant check on economy. Maintenance experience with the electrically-driven ships by the General Electric Co. and the British Thomson-Houston Co. has shown that the upkeep of the electrical machinery has been practically nil so far.

The tendency lately is to put some of the large and medium size liners on winter, or other, cruises when the season is slack. With electric drive about three-quarters speed can be obtained by the use of only one of the two power units, which means a very large saving in fuel and attention; the steam consumption per s.h.p. will be practically the same as that at maximum speed. In the design of the generators and motors special precaution has been taken so that, should damage occur to any part of the windings, it can quickly be repaired, or temporary quick repairs can be made, so that the ship can proceed at slightly reduced speed. Multiple circuits are used in the generators and motors so that in many cases (for instance if a coil is damaged) it can simply be cut in two with a hack saw, the ends insulated, and the loss in power will be only the ratio of this one circuit to the total number of circuits in multiple; for instance, if the motor has 10 circuits in multiple, and one circuit is cut out, the power is reduced only 1/10th, which will be practically unnnoticed, and the repair should take only a few minutes. If several coils are damaged a jumper can be connected across the damaged coils and the vessel can proceed Electrical repairs are always easily made when fully understood. Electric drive in many cases may afford important advantage because the generating unit, or units, can be placed in any convenient place near the boilers; they can be mounted at any height desired, the condensers can be put directly under the turbines, thus reducing the steam and the exhaust piping to a minimum. Chances of air leaks, which are so detrimental to obtaining good vacuum, are reduced to a minimum. The propelling motors can, in many instances, be put near to the propellers, eliminating long, expensive, shafting and the bearing losses incident thereto. Shaft alleys can be eliminated, thus saving hold space and making cargo handling much easier and convenient.

The turbine for electric transmission can be built more efficient; no reversing wheels are required, thus the turbine becomes shorter with a smaller shaft, less diaphragm packing leakage, packing and bearing losses. Since there is no heat distortion during reversal, smaller clearances can be used with the same factor of safety, all of which goes toward greater economy. Full advantage can be taken of the economy derived from high steam pressure and super-heat; as the turbine is never reversed, it cannot be subject to extreme temperature changes.

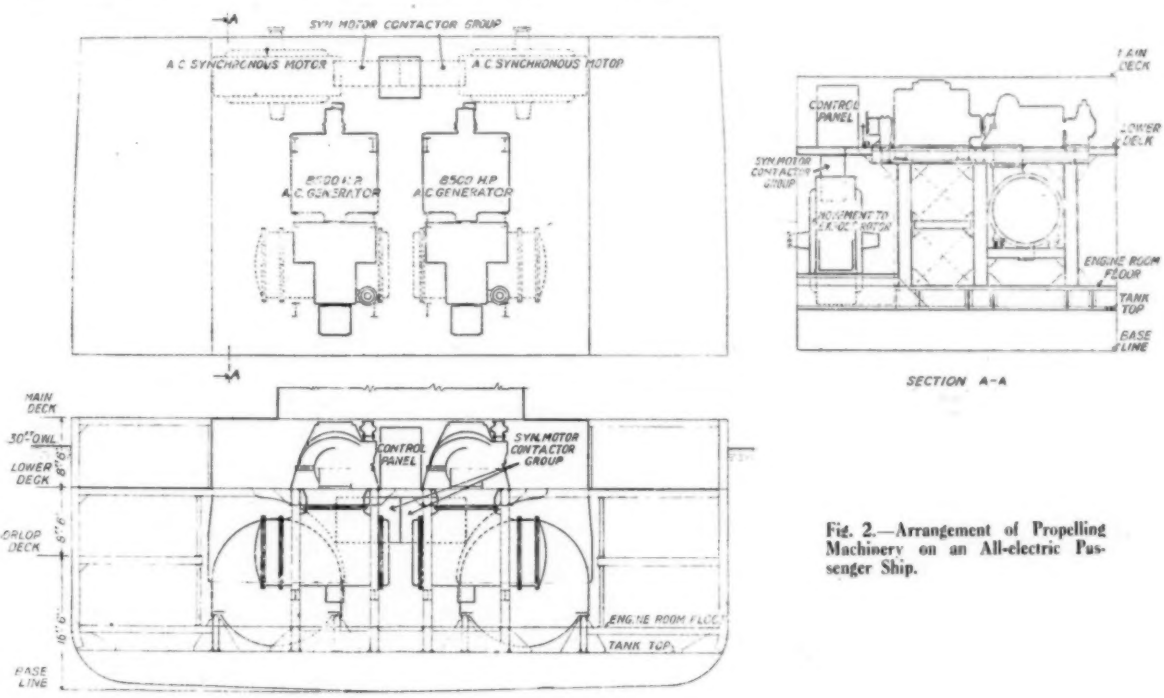

Fig. 2.—Arrangement of Propelling Machinery on an All-electric Passenger Ship.

Diesel-Electric Drive.—Since the adoption of Diesel-electric propulsion for the beam trawler *Mariner*, which was put in operation early in 1920, there has been marked progress in the application of this type of propulsion over a wide range of vessels—there now being some forty-five ships using this type of drive in operation, or under construction, including tug, ferry, and cargo boats, oil tankers, dredgers, and coast guard cutters. The largest Diesel-electric equipment installed at present in any single ship is of 2,500 shaft horse-power and it would not be surprising if, in the near future, someone went ahead with this form of propulsion in larger capacities.

The most promising field at present, however, seems to be in the smaller craft, especially where a large percentage of the installed horse-power is required for driving auxiliaries, for the same prime mover can furnish the power for both auxiliaries and propulsion; it is admitted that this form of propulsion has its limitations, but operators who have Diesel-electric driven ships seem very well pleased with the results obtained.

The paper includes a list of electrically-propelled ships built and on order to date, the number of such ships being 49 and the total shaft horse-power 561,615. Of these 21 are Diesel-electric ships, aggregating 14,815 s.h.p.. This list shows that great headway has been made in the application of electricity for the propulsion of ships. With the advent of high steam pressure, superheat, steam extraction for feed heating, as well as possible reheating between stages, electric propulsion makes the simplest ideal installation, and results can be obtained equal to, or better than, the best Diesel when total fuel consumption of the whole ship is taken into consideration. Electric propulsion is also ideal for the mercury turbine should this be considered for ship propulsion. Results so far obtained on land prove conclusively that this type of prime mover is more economical than the best of Diesel engines produced so far.

Railway Electrification in France.

Some Particulars of a Section of the Orleans Railway.

By H. PARODI.

(Abstract of a Paper read before a joint meeting of the INSTITUTION OF ELECTRICAL ENGINEERS *and the* BRITISH SECTION OF THE SOCIETE DES INGENIEURS CIVILS.)

THIS paper does not describe in detail the important electrification scheme now being carried out by the Orleans Railway Company, but merely outlines those features which show how the scheme fits into the general electrification programme of France. In the first part of the paper, the author has outlined the main factors which have dominated the whole of the investigation regarding the scheme of electrification in France and the development and economical use of the country's water power. The second part of the paper is devoted to a brief description of the electrical equipment installed, or being installed, by the Orléans Company.

PART I.

The electrification of the Orléans Railway is of particular interest, not only on account of the importance of the scheme, but also owing to the magnitude of the problems arising in carrying out the work. It was a question not merely of substituting electric traction for steam traction on a line having a dense traffic, but also of providing a large distribution system of which the power plants and transmission lines could

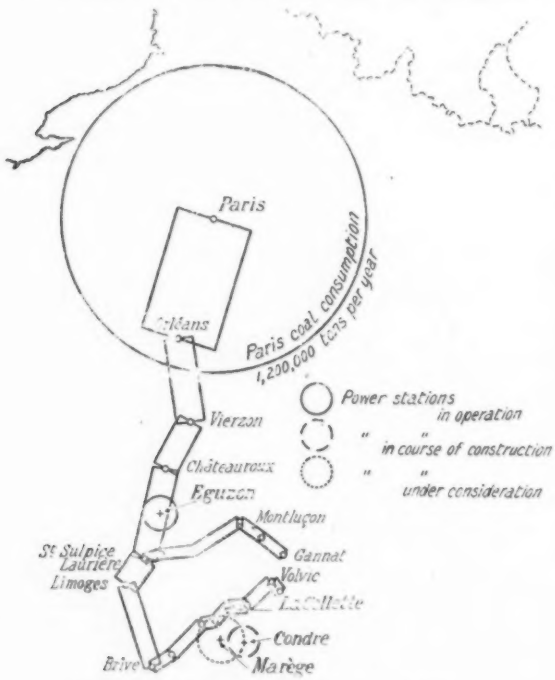

Fig. 1.—Coal Consumption in Electrified Areas.

be utilised for a supply of electric power in all the districts through which the railway passes.

The policy adopted in France in connection with the electrification of the railways is substantially different from that followed in other countries. The substitution of electric power for steam on the railways is considered in France to be one stage of a more comprehensive scheme, whereas in Germany, Switzerland, Austria, Sweden, Norway and other countries, the electrification of the railways is considered independently of the problem of a general supply of electric power. The railways in all the countries mentioned belong to the State, and special power stations and transmission lines have been installed for the generation and utilisation of single-phase current at low frequencies. Two entirely separate and indepedendent systems are thus being developed side by side, the power supply to the industrial system being by three-phase current at 50 periods, and the State power-supply system for electric traction being single-phase current at a frequency of 16⅔ periods. The only indication of a desire to establish at a later date an electrical connection between the traction and industrial systems, with a view to an exchange of power between them, is that the ratio between the frequencies of the two systems is a whole number, namely $50 \div 16\frac{2}{3}$, *i.e.*, 3.

In Great Britain, France, Belgium, Holland, Spain, Africa (Morocco, Algeria and Natal), as well as in South America (Chile, Argentine, &c.), electric power for traction will be generated and transmitted in three-phase form at 50 periods (60 periods in South America).

Other countries which have followed the policy of interconnecting the traction and industrial power systems have adopted high-pressure direct current at 1,500 to 4,000 volts as their standard for traction. Such current can, of course, be obtained whatever the frequency of the supply. It should, however, be pointed out that in certain countries, such as Italy and Hungary, very interesting tests are at present being made with a view to using for single-phase or three-phase traction three-phase current of a frequency such as is employed for the industrial supply. In Italy three-phase locomotives, having gears and connecting-rods and using current at the industrial frequency, have been tested on the Mont Cenis lines; and single-phase and three-phase 50-period locomotives fitted with synchronous converters on De Kando's system are under test in Hungary on a suburban line near Budapest.

This development, which is taking place in countries where low-frequency alternating-current traction has been in operation for a long time, proves, more conclusively than any theoretical considerations, the practical advantages to be obtained by standardising the various systems adopted for the generation and transmission of electric power.

As the main flow of traffic always follows the same direction whatever the form of transport, it would seem that the general direction of the main power-transmission lines should practically coincide with that of the railway lines which have a very dense traffic, and such railway lines are, as a matter of fact, those where the question of electrification is of most interest. For instance, the railway from Paris to Toulouse through Orléans, Limoges and Brive, is the route of the power-transmission line which would allow of an exchange of power between the large steam-driven power stations of the Paris district and the hydro-electric stations of the Central Plateau and the Pyrenees.

It will therefore be understood why the French Government had, even before the war, brought pressure to bear upon the large railway companies supplying districts rich in water power to electrify their systems so as to prepare the way for a still more extensive electrification.

The total coal consumption in France now reaches about 70 million tonnes per year, 75 per cent. of which is obtained from the country's mines and 25 per cent. from English, Belgian and German mines. The whole of the French railways do not consume more than 9 million tonnes, *i.e.*, about 13 per cent. of the total. In order to obtain an appreciable reduction in the amount of coal purchased abroad, which forms a serious item in the trade balance, it is necessary to transmit electrical energy obtained from water power to large cities like Paris, Lyons, Bordeaux and Toulouse, where the coal bill in connection with the generation of the electrical energy required for industry, namely, motive power and lighting, is far bigger than that for traction purposes.

Fig. 1 clearly shows this condition. On each railway line where the electrification is complete or nearly so a rectangle has been drawn having its area proportional to the 1913 consumption of coal for traction on railways. In this connection it should be remembered that the traffic figures for 1913 are now exceeded on all the railways. The circle round the Paris area represents, to the same scale, the fuel consumption in the steam-driven power plants of the Paris district which supply the industrial requirements for electric power and lighting. The amount of coal thus consumed in Paris (1,200,000 tonnes in 1924) is more than three times greater than the coal consumption for steam haulage of all the trains of the Orléans Company between Paris and Brive. By the end of 1935 the consumption of electrical energy in Paris will reach 2,000 million kWh, whereas requirements for electric traction on the Orléans system (the lines from Paris to Brive, from Saint Sulpice to Gannat, and from Brive to Clermont) will very probably not be higher than 400 million kWh. The maximum demand in Paris will be about 1 million kW, whereas the traction demand will not exceed 80,000 kW. The whole problem of the electrification of the Orléans Railway has been dominated by the desire to transmit electrical power from the Central Plateau to Paris without burdening the railway electrification with capital charges which are out of proportion to the present traction requirements. The solution of this problem has been found in the systematic use of transmission lines at as high a voltage as possible.

The use of very high voltages presents considerable advantages from an electrical point of view, particularly in connection with the great strength of such lines and their almost complete immunity from atmospheric phenomena. Economically the advantages are not less important, and they become more evident when, bearing in mind that the amount of power which can be transmitted to a given distance varies as the square of the voltage, it is found that the first cost increases practically only as the voltage.

Owing to the increase in the transmission voltage, a saving is certain to result if we transmit over the same line a long-hour load such as traction (say, 4,000 to 5,000 hours per annum), and a shorter-hour industrial load (2,000 to 2,500 hours per annum).

With the pressure of 150 kV now used, it is possible to transmit economically 40,000 to 50,000 kW from the Central Plateau to Paris, a distance of about 280 miles. By increasing the pressure to 220 kV, however, it would be possible to double (*i.e.*, $220^2/150^2$) the amount of power transmitted, and to superimpose on a traction load of 30,000 to 40,000 kW a power load of 60,000 to 70,000 kW, which could be used for industrial power and lighting.

The high-pressure system of the Orléans Company now includes a 150-kV line which can later be converted for use at 220 kV by the addition of a few units and a shield to the present chain insulators. The sizes of the aluminium conductors with their steel cores (293 mm² total section), and also the dimensions of the towers, have been based on the ultimate adoption of the higher pressure. In fact, the normal distance between the conductors (about 25 ft. 6 in.), and that between the conductors and the main supports (about 10 ft.) are larger than those actually employed on the 220-kV lines in operation in California.

In countries like Great Britain where electric energy can be obtained only by burning coal, and in countries possessing waterfalls fed from water sources all of the same type, as in Switzerland, the problem of the generation of electricity is almost exclusively a technical one, particularly when, as is the case in both the countries mentioned, the coal resources in one and the water-power resources in the other are very much larger than the national requirements.

The problem becomes, however, much more complicated in countries like France, where important coal resources and considerable water power are both available at the same time, although the amount of water power varies throughout the year. The coal resources of France are estimated at 22,000 million tonnes*, taking into consideration only those deposits which can be worked with the appliances at present available. With the present output of 40 to 60 million tonnes per annum, coal will thus be available in France for between 400 and 500 years. The water-power resources, which are renewed every year by solar heat, are estimated to represent normally about 5 million kW, of which about 3.3 million kW is in the form of waterfalls fed by glaciers, and 1.7 million kW is in waterfalls depending for their water-supply on rain. Of this total, only 0.67 million kW was being utilised on January 1st, 1925, whilst 0.28 million kW was in course of development at the same date.

The present consumption of electrical energy in France is about 7,500 million kWh, of which about 4,500 million kWh are generated by steam plants, the output of which represents 2,000 hours' use per annum, and 3,000 million kWh are obtained from water power, representing 4,300 hours' use. The combined load of the inter-connected electric distributing systems represents about 2,500 hours' use per annum, *i.e.*, a load factor of about 28 per cent.

The French Government is at the present time considering in close co-operation with the manufacturers, a programme of gradual equipment and of progressive linking-up of the various distribution systems, rather than Government control of electricity generation. The problem is too important, from the point of view of the country as a whole, for the Government not to try to outline the method of generation to be followed; and it is also too complicated, owing to the various opposing interests, to admit of the laying down of a hard-and-fast technical solution.

From the point of view of the rapid utilisation of the waterfalls, decentralised efforts are perhaps desirable, but as regards the operation of the plant and its efficiency, unity of control is essential.

Fig. 2 shows the relative variation in the number of kWh generated and consumed per month, compared with the number generated and consumed per year. The left-hand side of the figure shows the percentage variation in the number of kWh generated by the flow of water in the case of a plant depending on rain for its supply (Central Plateau stations), and also of a plant where the water comes from glaciers (Alpine stations). The right-hand side gives the monthly variations in load of an electric railway system and of an industrial system supplying power and lighting.

As the ouput curves of water-power plants depending on the rainfall are approximately of the same shape as the consumption curves of industrial systems, we can see at once the advantage which there would be in supplying electric power to Paris from the water power of the Central Plateau, it being particularly easy in this case so to adapt the power available that it will meet the demand.

This was realised by the Government when it authorised the Orléans Company to form, with the help of the Société l'Union d'Electricité, the Société l'Union Hydro-Electrique, in order to install the Eguzon water-power plant on the River Creuse.

The fact that this plant has a dam allows the storage of a sufficient quantity of water to form a weekly reserve, without the possibility of seasonal regulation. Owing to the working in parallel of the Eguzon plant (50,000 kW installed) and the large steam power-stations of the Paris district, it will be possible to utilise to the fullest extent the power available from the River Creuse.

In the first stage of the electrification of the Orléans system, the Eguzon plant will represent in the system of power stations of the Société l'Union d'Electricité the equivalent of a 50,000-kW set located at a distance of 300 km (186 miles). This set will be started when water power is available from the Creuse, and it will be stopped when there is no water; but the existence of the weekly reservoir will allow, on the other hand, this power to be used at any time during the 24 hours when this reserve will be most advantageous from the point of view of either economy or reliability.

In the second stage of the electrification of the Orléans system, use will be made of power generated by the hydro-electric plants of the Haute-Dordogne. The equipment of the waterfalls will include for the most important power plants the construction up-stream of a reservoir, in order that the adaptation of the available power to the demand may be secured by the use of this reservoir and by the exchange of power with a neighbouring system having water power-plant of a type complementary to the Central Plateau plants.

Owing to this combination and the policy of mutual assistance, the electric traction service of the Orléans Company will be operated under exceptionally reliable conditions, without the average demand for additional steam power being more than 10 per cent. of the total power. Should, in the future, large amounts of hydro-electric power be transmitted from the Central Plauteau to Paris, the lines of the Orléans Company could be easily adapted for this transmission.

In superimposing the industrial load on the traction load of the various 90-kV and 220-kV lines, it would be possible to transmit economically 100,000 kW a distance of 450 km (280 miles). The author thought it advisable to emphasise this question of electric power production in a complex system, because on its more or less favourable solution depends the success of the electrification, not only of the railway, but also of the whole country it supplies.

If in a country possessing an abundant supply of coal such as Great Britain considerable attention is given to the most economical methods for the generation and distribution of

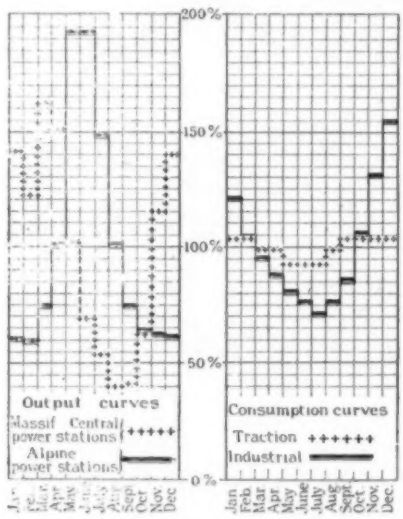

Fig. 2.

power, it can readily be understood how in France this problem is becoming very important and urgent.

(To be concluded.)

*Metric tons.

Discussion in London.

Mr. ROGER T. SMITH opened the discussion by thanking the Institution of Electrical Engineers, as a member of the British Section of the French Society of Civil Engineers, for the facilities afforded to Mr. Parodi for the delivery of his paper in London; and, on behalf of the I.E.E., he thanked Mr. Parodi for coming to this country and giving such an excellent paper. France, he said, was the only country which was working its railway electrification in with a national supply scheme. A great advantage to be reaped by the electrification of the main railways was the speed increase of goods traffic. If distance and time curves were plotted for both goods and passenger traffic, electrification resulted in the two lines or sets of lines becoming nearly parallel—the ideal case—and an average speed of 40 m.p.h. could be easily obtained. This resulted in the opposite to the present conditions, where slow-speed trains were employed, of increased traffic on congested lines. He referred to the excellent conditions of load balance brought about by the opposite seasonal variation in the two French water-power sources for the Central Plateau and the Alpine stations, which had their maximum and minimum outputs at different periods. He thought that interconnection between the two supply centres was essential to the French problem: there was nothing between Paris and Brive except Orleans. The theory was held by some in this country that advantage would be gained by linking up the large centres with h.p. interconnecting lines. He doubted whether such a scheme would be practicable, or whether economy would ever result from it.

Col. O'BRIEN paid a tribute to Mr. Parodi and other French engineers who had conceived the vast electrification scheme. He said it would be interesting to know if the tonne-km. per km. referred to in the paper represented gross or net values. He also asked what precautions were taken in connection with

the very h.p. feeders with regard to the communication circuits. He thought that the type of locomotive without connecting rods would be the most successful, and that the 2D2 type would prove the best. He would be interested to know the anticipated cost of energy; many people had the impression that water power was cheap compared with coal. He criticised the French third rail; it appeared to be expensive and complicated compared with the other patterns. On the whole the paper demonstrated the superiority of electricity over steam, and he thought the paper should be read before the other engineering institutions.

Mr. F. LYDALL said the Institution was to be congratulated on having a paper with such a wide range read before it. He thought the principal consideration in connection with main-line electrification was whether the railways should generate their own supply or depend on other concerns. Many railway engineers felt that the question of security of supply was of the first importance. There were undoubted advantages in taking the supply from the general system, but in such a case the general and financial position of the supply undertaking should be beyond reproach. He felt that the circumstances in France were peculiar, and did not apply in this country. A mistake was the tendency to regard railway electrification as something to be "nibbled" at. The sections which were often electrified as commencing stages were too small to show any advantages, and the Paris-Orleans line was an example of how electrification should be dealt with. He advocated the large supply system for railway electrification. On a badly intermittent railway 3,000 kW might be thrown on or off; this would be serious if the supply was from a small station, but on a large system such fluctuations were not important. In a case he had in mind the average load was 9,500 kW, the sustained load 17,000 kW, and the peak load (two minutes) 25,000 kW. He thought too much attention was paid to the question of weight of the locomotive; in some cases it was necessary to increase the weight.

Mr. F. W. CARTER said that the outstanding feature of the paper was that it dealt with the electrification of an ordinary railway. Most electrification schemes were the outcome of special problems such as fuel shortage or dense urban traffic such as that around London. In some cases drainage problems or the question of long tunnels brought about schemes for electrifying the lines. The Paris-Orleans railway was a plain line, and if the undertaking proved successful it would show that the programme could be applied to all normal railways. The principal difficulty in the problem of main-line electrification in this country was the question of capital outlay.

Major A. M. TAYLOR said that in extending the electrification scheme to meet the industrial load in Paris the French Government had done very well. If it paid the French people to transmit a heavy load over a 280-mile line, would it not pay in this country with the present generating costs? The success of the transmission of heavy loads no doubt rested in the question of increasing the transmission pressure. Engineers were not bold enough when preparing schemes of power transmission. Estimates were prepared for loads of 20,000 or 30,000 kW, and did not prove economical; really large loads and high pressures would give better results. On a 100-mile line transmitting 125,000 kW with a 33 per cent. load factor, the sinking-fund and repair charges would be about 0.025d. per kWh, and the loss charge would amount to about 0.017d. per kWh resulting in a figure for the total charges as low as, say, 0.045d. per kWh. In America the transmission of 100,000 kW at 220,000 V was effected with a steam station at each end and a synchronous apparatus at the middle of the line.

Mr. E. M. MALEK said the French authorities had grasped the essentials of railway electrification in co-operating with the industrial interests. The paper dealt only with one of the three main French schemes, and it would be interesting to know the results of the whole programme. The capital outlay for electrification on a large scale was enormous because of the distribution lines.

In reply, Mr. PARODI said, *inter alia*, that better results were hoped for as the load on the transmission lines increased. Electrification had resulted in maintaining full speed up the severe gradients, where with steam it had only been possible to result in ¼ speed at the top. The tonne-km. per km. referred to did not include the locomotive. He regretted that comparative energy costs were not available except that in the case of Eguzon the water-power cost was only half of that for steam power—but the ratio was not general. The French railways preferred to use the plant of the supply companies.

Combating Electrical Fires.

The "Lux" Liquid CO_2 System for Power Stations.

THE very serious consequences of electrical faults in large power stations which involve a fire risk have emphasised the need for means of combating conflagration of an electrical origin. The

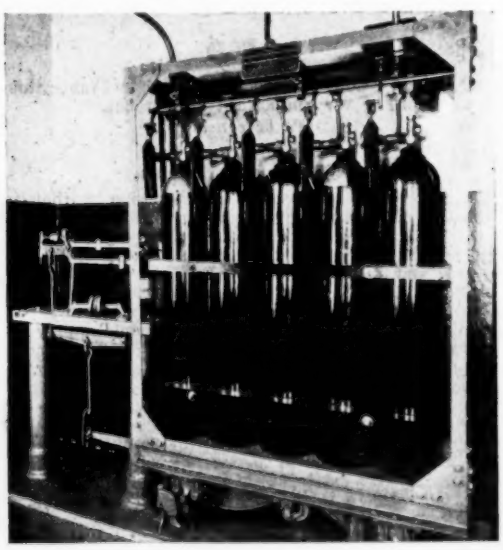

Fig. 1.—CO_2 Cylinders on Scale Balance.

usual chemical extinguishers afford excellent first aid protection, provided the seat of the fire can be reached easily in the very early stages, but a fire in a large enclosed generating set cannot be dealt with by such means; or, again, should an oil switch explode in a large switch room it may speedily become quite impossible to cope with the fire that may result from the spreading of the burning oil, which, in turn, may involve other switches and lead to very serious damage and dislocation of supply.

It was to meet this state of affairs that the "Lux" method of fire extinction was developed. This system was first used to deal with ship fires in cargo holds, oil-fired boiler rooms, tankers, &c., and it has been applied to the electrical field, having been installed by Walter Kidde & Co. (Inc.), in power stations in America and other countries.

Carbon dioxide in a pure liquid state is stored in steel cylinders of the usual commercial type, but provided with special valve gear which makes it possible to release in a few seconds very large quantities of the liquid through small-bore

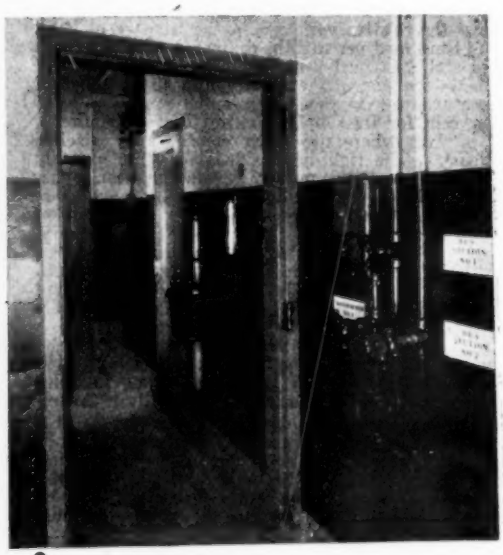

Fig. 2.—Hand-operated Direction Valves and Remote Electrical Release Gear.

pipe lines into the atmosphere surrounding the electrical gear to be protected. The liquid CO_2 at once expands into gas, producing an inert atmosphere in which no fire can live; the

very considerable refrigerating action (due to the rapid expansion) produces a chilling effect at the seat of the fire. Carbon dioxide gas has no effect upon insulation, or metals, and its dielectric strength is greater than that of air; thus it can be employed with safety on live high-voltage installations.

The "Lux" system as applied to, say, a number of oil-switch rooms would consist of cylinders of liquid CO_2, fitted with quick-release valves which prevent the liquid freezing before it reaches the fire, manifolded together and connected through distributing valves to piping running to the various switch rooms where the pipes terminate in nozzles arranged to totally flood the whole of the room involved. All the valves can be arranged to be operated either electrically, from any position remote from the switch room, or manually. It is claimed that a room of any size can be completely flooded with CO_2 in a period of from 30 to 40 seconds after operating the quick-release valves, thus extinguishing a fire of any magnitude and at any height in the room, within from 5 to 40 seconds.

This rapid action is one of the secrets of the success of the system, as it gives the fire no time to remove the gas by ventilation, even though a door or window be open. The gas gradually becomes dissipated by ventilation until, after a time varying from ½ to ¾ hour, no CO_2 remains; thus, a protecting blanket of gas remains for a sufficient time to allow the heated apparatus, oil, &c., to cool. No damage is done by the gas, it is claimed, and there is no moisture or residue to clear up afterwards. Transformer cubicles can be protected in the same way, and the system is particularly adapted for dealing with fires in cable trenches.

Where a batery of cylinders is installed for totally flooding a room, it is advisable to provide a length of hose terminating in a hand nozzle and mounted on a reel, which provides a ready means of dealing by hand with fires in their initial stages. A still smaller, portable, hand apparatus connected to one gas cylinder only has been developed to deal with switchboard fires, and many thousands have been supplied to the telephone companies in America for this purpose.

Success in dealing with a generator fire depends, first, upon extinguishing it within a few seconds of ignition, and, secondly, upon limiting smouldering and preventing re-ignition during the period in which the generator is coming to rest, and for a reasonable time afterwards. In the case of a totally-enclosed machine with a water-cooled ventilating system, two banks of gas cylinders are used: The first contains enough CO_2 to give the whole ventilating system a high enough gas content to extinguish flame within from 10 to 20 seconds of injection. The valve gear is operated electrically by a solenoid actuated by the differential relay of the generator, or it can be arranged for push button control. At the same time that this charge of gas is injected, the turbine throttle would be tripped and t machine would commence to come to rest; meanwhile, due to leakage in the ventilating system enclosure, fresh air would enter the machine and might cause re-ignition, or serious smouldering. The amount of air leakage as discovered by CO_2 gas analysis tests on a number of machines is usually more than is realised, amounting to as much as from 10 to 15 per cent. of the ventilating system volume per minute at normal speeds.

Therefore, the contents of the second bank are injected into the ventilating systems one cylinder at a time by means of delay-action mechanism, so that the CO_2 concentration rises rather than drops, for the whole period that the machine is coming to rest. Hence, the fire can be definitely prevented from spreading round the coils and damage can be confined to the one or two turns which originally broke down.

When machines of the closed type, but with open ventilating systems and air filters are to be protected, special shutters must be provided to convert the machine into a closed type in the event of fire. A number of machines may be protected by means of one cylinder outfit, simply by providing electrically-operated distribution valves and the necessary piping. The action throughout is entirely automatic, and, as will be seen from fig. 1, the battery of cylinders may be mounted on a scale balance to indicate loss of gas by weight. The cylinders are under moderate pressure (744 lb. per sq. in. at 60 deg. F.) and provided with safety valves. Figs. 1 and 2 are views of the installation which protects the oil switches and transformer vaults in the East End sub-station of the Duquesne Light & Power Co., Pittsburgh, Pa., U.S.A. The "Lux" system is understood to be of Swedish origin; it has been developed in America, and is now available in England.

Parliamentary News.

[By Our Special Parliamentary Reporter.]

Electric Lamps in Mines.—On February 16th, Mr. W. PALING asked the Secretary for Mines the number of pits in Great Britain where electric lamps were used underground.

Colonel LANE-FOX said that at the end of 1924 there were 356,817 electric safety lamps in use, practically all of them underground, at 1,012 mines.

Imperial Wireless Communication.—On February 16th, Mr. DAY asked the Postmaster-General the present position with regard to the Imperial wireless chain; and what had been the results of the tests made from the Imperial wireless station at Rugby.

Sir W. MITCHELL-THOMSON said that the contractors hoped to complete the Bodmin and Bridgwater stations, which were to be used for the Canadian and South African services early in April, and the Grimsby and Skegness stations which were to be used for the Indian and Australian services, in August next. The corresponding stations in the Dominions and India would, it was understood, be completed at about the same time as the English stations. The tests of the Rugby station showed that it could be received in all parts of the world. The station had been used regularly for the official wireless news service since January 1st and for the transmission of long-distance radio telegrams to ships since January 31st. Owing to its world-wide range, messages could be sent from Rugby to ships at any point on the high seas, however remote; and considerable use was being made of the new facilities thus afforded. The question of operating other services from Rugby was under consideration.

On February 16th, Sir H. BRITTAIN asked the Postmaster-General with which parts of the Empire his department was now in direct wireless communication; and whether any further developments were in contemplation during the current year.

Sir W. MITCHELL-THOMSON said that there was at present no two-way communication by Government wireless between this country and the Dominions, though it was hoped to open such a service during the current year with Canada, South Africa, India and Australia, by means of the beam stations, now under construction here and in those countries. As regarded one-way communication, there had for some years been a regular Press service between Leafield and Halifax, Nova Scotia, and the opening of the Rugby station had now made it possible to broadcast messages for reception in any part of the Empire. At present official news messages were sent out from Rugby thrice daily and good reception of these was reported from places as far distant as New Zealand. In addition private messages for ships anywhere in the world were now regularly transmitted from Rugby and reception appeared to be satisfactory.

Broadcasting.—On February 18th, on a Supplementary Vote for £847,000 for salaries and expenses of the Post Office, including telegraphs and telephones, Lord Wolmer, Assistant Postmaster-General, said that the estimate included £223,000 for radio broadcasting. All the moneys collected for licences had to be surrendered by the Postmaster-General to the Exchequer, and the authority of Parliament had to be obtained before the Treasury could pay out its share to the British Broadcasting Company. It was estimated that the number of licences would entitle the B.B.C. to the sum of £350,000; as a matter of fact it had been paid £573,000. Therefore the supplementary estimate was necessary, but it had not cost the country a single farthing. The item of £190,000 for engineering materials was due to expenditure on a greater purchase of ducts and cables for telephone development than had been estimated last year, and also to quicker work on the part of the contractors.

Mr. AMMON thought that further information should be given as to the expenditure of the B.B.C., a body which was financed by Parliament and was placed in a specially privileged position. A feeling was entertained in certain quarters that the business of the company was being run extravagantly.

Lt.-Commander KENWORTHY contended that the sum of 2s. 6d. charged by the Postmaster-General for issuing a 10s. licence was preposterous. The Post Office must be making an enormous profit. He had been told that the book-keeping charges for similar work by commercial firms worked out at less than 1s. per cent. The Postmaster-General might say that he relayed the programmes over his telephone wires. But this was done at a time when the wires were not in much use, and the relaying was bad. That position would have to be faced presently if the Postmaster-General was to give value for money; he must lay down special telephone wires.

Sir W. MITCHELL-THOMSON, the Postmaster-General, said that at present the question of the future development of broadcasting was being considered by Lord Colwyn's Committee, which hoped to present a report at the beginning of March. It was probable that legislation would be required as a result of this report. As to the suggestion that the Post Office had been guilty of faulty relaying, he had received no complaints from the B.B.C. on that score.

The London Power Company Bill.—On February 22nd, on the order for the second reading of the London Power Company Bill, Mr. ATTLEE, on behalf of the Labour party, moved the rejection of the Bill, the introduction of which, he said, was entirely premature, and which was in direct contravention of the policy of the Government and of the House. The Joint Electricity Authority for London and the Home Counties, which was only established in November, was already considering a technical scheme for bringing the electricity supply of London up to date. The present Bill sought power to set up a capital station in the West London area before any report had been made on that technical scheme. The Joint Electricity Authority was already very forward with plans for a generating station, and was actually in negotiation for a site for it. The site selected by the company was not the best one available.

In the course of further debate, Mr. HANNON pointed out that the Joint Electricity Authority would not be in a position to supply electricity for four years, and the London Power Company had a scheme already elaborated.

Col. ASHLEY, the Minister of Transport, said that, candidly, he was sorry that the Bill had not been held back until the

electricity proposals of the Government had been brought forward. The House would then be better able to pass judgment on such a scheme. At the present stage he must take an absolutely impartial and non-committal attitude. He would advise the House, however, that before the Bill left its control, Section 11 of the Electricity Act of 1919 should be inserted. That would mean that the Electricity Commissioners would have to decide whether the station referred to in the Bill should be built by the London Power Company or by the Joint Electricity Authority. He would also suggest that there should be inserted in the Bill a clause giving an option of purchase to the Joint Electricity Authority if the Electricity Commissioners decided that that Authority and not the Power Company was the body to build the station. He hoped that before the third reading of the Bill was taken, the Government proposals would be before the House, and they could judge what reception they should give to the measure.

The Bill was eventually rejected by 137 votes to 110.

Legal.

Attorney-General (St. Pancras Borough Council) v. County of London Electric Supply Co., Ltd.

Mr. Justice Tomlin gave judgment in the Chancery Division on February 19th in this action. The point at issue was whether the defendant company or the St. Pancras Borough Council were entitled to supply electricity to the new buildings erected by Messrs. Hulton in Gray's Inn Road, W.C. His Lordship said that the boundary line between the borough of Holborn and the borough of St. Pancras formerly ran east and west through this property. By an Order in Council dated May 15th, 1900, the boundary was moved further south, bringing the whole of the property within the boundary of St. Pancras. The relators (the St. Pancras Borough Council) were and had been at all material times authorised under the St. Pancras Electric Lighting Order, 1883, to supply electricity within an area that comprised the southern boundary of the property in question. The defendant company had, since 1897, under the County of London Northern Extension Electric Lighting Order, 1897, been authorised to supply electricity in an area corresponding with the borough of Holborn. The area of supply of the St. Pancras Council extended southward only to the old boundary of the borough of St. Pancras, and included the northern part, but not the southern part, of the property, while the area of supply of the defendant company extended northward as far as the old boundary and included the southern part, but did not include the northern part of the property. Messrs. Hulton, having completed part of their proposed building, approached the St. Pancras Council to negotiate terms for a supply of electricity, the St. Pancras Council being then erroneously under the belief that its area of supply included that portion of the borough that had been transferred from the borough of Holborn. Ultimately these negotiations were broken off, and Messrs. Hulton entered into a contract with the defendants for a supply of electricity. The amount of electricity being consumed at present upon the land south of the old boundary was trivial compared with that being consumed on the land north of the boundary. The St. Pancras Council claimed that electricity was being illegally supplied by the defendants outside their area of supply. Defendants contended that the supply given by them to Messrs. Hulton was given within their area of supply. His Lordship found that a substantial part of Messrs. Hulton's property was within the area of supply of the defendants, and that only a small quantity of electricity was at the moment being consumed on that part, but that there was reasonable ground to anticipate an increased user in the near future. He also found that the ends of the lines belonging to Messrs. Hulton on which electricity was passed to them from the service lines of defendants were within the area of supply of the defendants, and that the consumers' terminals of supply were in substance and fact within defendants' area of supply. Throughout the relevant Acts and Orders he thought a distinction was drawn between supply and use or consumption; that point was illustrated by the phraseology of the definition of consumers' terminals in Section 2 of the Order, as the ends of the service lines on which the supply was delivered, and by the terms of the prohibition in Section 18 of the Act of 1882 against any interference by the undertakers with the manner in which any electricity supplied by them was used. He found that the obligation to supply and the power to supply were not necessarily co-terminous, and even if no supply could be demanded except in respect of and for premises wholly within the area, no argument was thereby afforded for limiting the power of supply if, apart from that contention, such power appeared on construction to be wider. The obligations and powers of the undertakers in relation to the supply to a particular consumer were, speaking broadly, confined to their own side of the consumers' terminals, and it was upon the undertakers' side of, or at the consumers' terminals, that the amount of the supply had to be measured and its pressure ascertained. The method of user of the supply, unless, at any rate, it resulted in interference with the efficient supply by the undertakers to other people, did not concern the undertakers at all or give them any right of inspection on the consumers' side of the terminals or right to cut off the supply. Section 5 of the Electric Lighting Act, 1909, and Section 8 of the London Electricity Supply Act, 1908, did not, in his judgment, afford sufficient ground for displacing the conclusion which otherwise he had arrived at. Section 5 of the 1909 Act seemed to draw a clear distinction between supply and use. Finally, he held that supply did not mean supply for use or consumption, but supply in the sense of delivery at the consumers' terminals. There was nothing in the language of Section 5 or 6 of the Order or in Section 23 of the Act of 1909 to render illegal that which, upon the facts as he had found them, the defendants were doing. It followed that the action failed and must be dismissed, with costs.

Correspondence.

Correspondents should forward their communications* at the earliest possible moment.** ***No letter can be published unless we have the writer's name and address in our possession.

The Government Electricity Scheme.

I trust you will allow me to reply to Mr. Allcock.

Perhaps I did not make myself clear, but the 3d. was the price of the current received at our works. If Mr. Allcock can distribute it at 6d., 2d. and 1d. and show a profit, I should be glad to hear how to do it.

In conclusion, even if I could buy in bulk at 3d. a unit at the switchboard here, I maintain that it is sheer folly and absolutely uneconomic to sell at any price less than 3d.

It would be interesting to have the opinions of some of our large commercial houses on this point. I cannot see Barker's or Whiteley's buying large stocks of apples at 3d. a lb. and selling at 1d. in the hope that someone will buy oranges at 6d. on which they may have a good profit.

C. Culmer Hodges.

Dawlish, *February 15th*, 1926.

The Cost of Living in Cyprus.

I should be very glad if you could give me, or refer me to someone who can, some details as to the cost of living, and general conditions, in Cyprus.

Cyprus.

February 15th, 1926.

The All-Electric House.

In his letter in your current issue, Mr. E. W. Dickinson states that I am at fault in quoting from the figures in his article "Fuel Economy and the All-Electric House."

He clearly gave gas 12½ per cent. of the 100 per cent. of the c.v. of the coal. In this connection the points in my letter will be clear enough.

But if it is now claimed that gas offers 37½ per cent. of the c.v. of the coal, alongside of 17 per cent. for electricity, what becomes of the miserable 30 per cent. for gas *plus* coke mentioned in the article?

I like Mr. Dickinson's good intentions to "make our industry absolutely impregnable." He can safely amuse himself by handing out scaling ladders to the assailants to prove it so.

February 19th, 1926. **Invictus.**

The Testing of Transformers.

We note in your issue of February 19th, 1926, page 289, a short article on "The Testing of Transformers; Some Observations on a Method of Ratio Testing," by Mr. D. Pedley.

While we have read Mr. Pedley's article with interest, we must submit that his criticism is unjust in that it refers to a diagram, fig. 2, drawn up by himself, which is obviously wrong, and will not function correctly.

Mr. Pedley has been misled by the abstract printed in your issue of January 29th. The full text reads as follows:—

"The low-tension winding is connected in opposition across a part of the resistance R, also tapped through suitable dial switches to a sensitive wattmeter movement to show the balance of the two circuits, the field coils of which are excited off the h.t. supply."

The wattmeter movement shown in our diagram has the field coils specially wound for the a.c. supply, and the moving coil is of low resistance.

Our diagram is only intended to show a general arrangement, and allows of several modifications depending on the type of transformer to be tested. We have had experience of three such instruments of different ranges for a considerable period, and find them of great service and accuracy. In one of these instruments the wattmeter field coils are specially wound to go across the supply of 220 volts, and the other two are arranged with a small transformer to step down from the supply to give the correct current for the wattmeter field coils.

The wattmeter is a polarised instrument, and is usually a centre-zero instrument; thus it can be marked to indicate + or − ratio error.

J. Lindley Thompson, M.Sc., M.I.E.E.
H. Walmsley.

Newcastle-on-Tyne, *February 22nd*, 1926.

North-West Midlands Electricity District.

Electricity Commission's Inquiry at Stoke-on-Trent.

ON Wednesday, February 17th, an inquiry was held at the Town Hall, Stoke-on-Trent, by the Electricity Commissioners, Sir Harry Haward and Mr. S. L. Pearce, with Mr. J. C. Dalton (legal adviser) and Mr. D. S. Cumberlege, with reference to the area to be included in the North-West Midlands Electricity District and to consider a scheme for improving the existing organisation for the supply of electricity and for the formation of a Joint Electricity Authority. The promoters were all the authorised undertakers within the district which had been delimited by the Commissioners, namely, the City of Stoke-on-Trent, the Borough of Newcastle-under-Lyme, the Urban District Council of Leek, and the Market Drayton Electric Light & Power Co., Ltd. They were represented by Mr. Craig Henderson, K.C. There were also present Alderman H. Keese and Mr. H. H. Battle, chairman and secretary, respectively, of the Conference of Authorised Undertakers promoting the scheme, and officials of the bodies concerned.

Mr. CRAIG HENDERSON said the area of the district was 756 square miles and the population was estimated at 530,703. The bulk of the population was gathered into industrial centres, but the greater part of the area was rural and agricultural. Provision was made for the erection of a new station when justified by the demand (on what was considered to be the most suitable site) at Barlaston, midway between Stoke and Stafford. The two main stations, at Stoke and Stafford, were capable of considerable extension; by bringing them up to a capacity of 31,000 kW and linking them with high-pressure mains, with further links to outlying places, immediate requirements would be fully met. Leek had its own station, but would soon want a supply from Stoke, and so a link from Stoke to Leek was proposed. Congleton was anxious to have a supply; it had none to-day, and a station of its own was not justified, so that provision had also been made for a link from Stoke to Congleton which would be connected also with Leek. At some date in the future Leek would be linked with Uttoxeter, and Uttoxeter with Stafford. Uttoxeter could not justify a station of its own, and Newcastle-under-Lyme was already linked with Stoke. When the territory in the south-west developed, Market Drayton could be linked through Newcastle and also directly with Stoke.

Sir HARRY HAWARD asked whether it was the idea that Congleton and Uttoxeter should obtain Special Orders to enable them to distribute electricity, the supply being taken in bulk from the Joint Authority.

Mr. O. W. WHITTER, Mayor of Congleton, said the Borough desired to have its own Order and become the distributing authority.

Mr. CRAIG HENDERSON stated that the Conference had no objection to the municipal bodies taking the course they thought best. The Council of Stone was applying for its Order, which would probably be a precedent for the others. The position to-day was that Stoke had the "chief power house," which had 17,000 kW of plant; there were two smaller stations with about 1,000 kW each which would be used as sub-stations for distribution purposes.

Ald. HARRY LEESE said he had been chairman of the Stoke-on-Trent Electricity Committee for 15 years and was also chairman of the Conference of Authorised Undertakers promoting this scheme. With regard to the administrative part, they were prepared to take as the general text the order made for the West Midlands District. The Conference was unanimous that the time had not come to erect a new generating station; by extending the stations at Stoke and Stafford the demand would be fully met for a considerable number of years. His Council was prepared to transfer the Stoke station to a Joint Electricity Authority, as the pooling of resources could not be done effectively unless that Authority had control of the whole of the supply.

Sir HARRY HAWARD: Have you considered the possible bearing which the Government's new electricity proposals may have upon this scheme? The Witness replied that they seemed quite nebulous. If a main transmission line passed through the area within easy distance of Stoke and Stafford it might be they would not require to build the Barlaston station, but, so far as the immediate supply was concerned, it would not have much effect. Their difficulty was not one of generation, but of distribution, and a cheap supply in bulk would not appeal to them unless it was cheaper than they could generate it for themselves.

Mr. ARTHUR ELLIS, M.Inst.C.E., M.I.E.E., M.I.Mech.E., said he had acted as advisory engineer to the North-West Midlands Conference. For the erection of a new station Barlaston was the best available site; there was, however, no need for a new station at present. During the last four or five years the demand had increased at the rate of 1,000 kW per year, but in his calculations he had assumed an annual increase of 2,000 kW during the next ten years. Extensions of 10,000 kW at Stoke and 5,000 kW at Stafford would meet the whole requirements, and the buildings for that plant were already available. Both stations could go up to 31,000 kW, and if necessary (by putting in larger sets) Stoke could be extended to 46,000 kW; by linking them together, the spare plant at one would be capable of meeting the requirements of both. The main link was a double circuit of 0.2 sq. in. operating at 33,000 volts, which would be extended, first, to Leek, and then come back, through Uttoxeter, to Stafford. The demand in Market Drayton did not justify a 33,000-volt line, and it was proposed to provide an intermediate system of transmission at 11,000 volts. He did not think the scheme could be dispensed with by taking a supply from a main transmission line passing through the district, if the Government proposals were developed in that direction. It would be a question of the terms at which supplies could be delivered, compared with the price at which they could produce their own. He did not contemplate that such transmitted supplies would be available in the next two or three years, and extensions must be made at Stoke or Stafford within that period. The extensions would cheapen production; they were now paying 16s. and 17s. per ton for coal. During the winter they had installed at Stoke four larger boilers of higher steam capacity and a 5,000-kW turbo-alternator, and the Stoke engineer was contemplating the possibility of raising steam from a cheaper grade of fuel, costing 14s. to 15s. per ton of less, and with the new plant in regular service the steam consumption would be something like 10½ lb. per kWh as compared with 13 or 14 lb. with the older plant. The same thing applied at Stafford, where new plant had been installed within the last 12 months.

Sir HARRY HAWARD asked what economies would be effected by linking the two stations and pooling their resources. In Mr. Ellis's opinion the economies to be effected would enable supplies to be available at the bus-bars at 0.675d. per kWh, after taking into account capital charges. There were five separate stations operating in the district, and the peak loads on all of them coincided; there was no diversity of load. The summer load was practically half the winter load and one station (under a proper arrangement) could supply the whole of the district.

Sir HARRY HAWARD: But you are not going to connect all these stations for 15 years? Mr. ELLIS replied that they wished to connect Stafford and Stoke immediately. The station at Leek could serve a useful purpose, but if the demand there required additional plant it would be cheaper to take a transmission main to Leek and give a bulk supply. Newcastle was already linked and taking the greater part of its supplies in bulk from Stoke. That left out Market Drayton, which was very remote. The demand at present was 130 kW, and a transmission main would cost something like £17,000. Taking a period of 10 years, during which extensions of 10,000 kW at Stoke and 5,000 kW at Stafford would be sufficient, he estimated that a kWh could be delivered at the bus-bars of the various distribution authorities at a cost of 0.608d., including all charges.

In reply to Mr. HERBERT, the witness said he did not know anything about the condition of the tramway generating stations. If the figures given him regarding the tramway requirements were correct (5,000,000 kWh, maximum demand 1,622 kW, load factor at one station from 34 to 37 and at the other from 38 to 42), it would be to the advantage of the Joint Authority to take the load. In the scheme under consideration he was working on the footing of a load factor of 30; his experience was that the tramway load overlapped the lighting load at the most awkward period of the day. If the tramway load could be fitted in between off periods, the Joint Authority would quote appropriate terms, but to do that it would be necessary to shut down the tramways during part of the day.

Answering Mr. PEARCE, the witness said the maximum demand for the year ending March 31st, 1925, was 12,907 kW. During the present winter the combined maximum demand had been 14,096 kW. According to his schedule the maximum potential demand in the district was 50,000 kW, divided between four different classes of supply. A difficulty arose from the fact that most of the collieries, which might be looked upon as potential customers, had their own blast-furnace plant and utilised their waste gases to provide their own supplies, but he did not think any works which had their own plant had been omitted in arriving at the total of 50,000 kW. It represented the ultimate possible demand at the time the figures were taken out. A very important manufacturing firm was proposing to establish works at Stoke, and negotiations were proceeding regarding the supply of electricity to that firm. An ultimate demand of some 10,000 kW of load was anticipated with a load factor of 50. This was not included in the 50,000 kW, which figure might be further increased by the introduction of new industries. His estimates of coal consumption showed that in 1930, the present average of 2.796 lb. being reduced to 2.25 lb., there would be a saving of 17,000 tons of coal, representing £12,000. The scheme set out what, to his mind, was the only way in which the rural areas could be opened out. Under existing conditions they could not develop a 33,000-volt transmission system to a place which had a maximum demand not exceeding 315 kVA. Of course, if the district developed at an

extraordinary rate, a cheaper line might be run. In a national scheme he assumed the pressure of transmission would be in the neighbourhood of from 110,000 to 120,000 volts. It would be better to have a Joint Authority representing a large area than five different authorities negotiating separately for supplies.

Mr. PEARCE was surprised that there was no diversity factor. Was there no difference between Stoke and Stafford?

Mr. ELLIS replied that they pretty well coincided, but he was not going to say that that would continue.

Mr. HERBERT asked that provision be made that if the Potteries Electric Traction Co. took a bulk supply, the company should not be required to pay more than it would cost to generate the supply itself.

Ald. G. P. DEAN, for the employés' side of the National Joint Industrial Council, suggested that the workers be allowed to have two representatives upon the Authority. Mr. W. A. JONES asked that there be one representative of the employés' side of the Joint Industrial Council and one representative of the employés' side of the District Joint Board.

Mr. CRAIG HENDERSON replied that at present the number of workers at the five stations did not exceed 60. When they got high-pressure main transmission and so on the number might go up to something like 100. One representative was sufficient. There was no objection to the working together of the two bodies representing the staff workers and the manual workers. The proposal put forward by the Potteries Electric Traction Co. amounted to asking that the amortisation charges for its present generating plant shall be borne by the Joint Electricity Authority.

The inquiry was then closed.

Trade-Mark Applications.

THE following are among the recent applications for British trade marks. Objections against any of the proposed marks may be entered within one month from February 17th :—

E.M.S. (lettering and design). No. 456,534. Class 6. Mechanical signs for advertising purposes. No. 456,535. Class 8. Electric batteries (not medical). No. 456,536. Class 13. Electric lamps (ordinary).—Electrical Name and Numerical Sign Co., Ltd., 30, Little Newport Street, Charing Cross Road, W.C.2.

Orion. No. 465,918. Class 6. Electric vacuum cleaning machines.—Electrical and Manufacturing Co., 7-13, Clavering Place, Newcastle-on-Tyne.

Radio Palaba, P.S.P.S. No. 465,906. Class 8. Instruments and apparatus for use in radio-telephony.—Pala. A. Spal, Stany, Czecho-Slowakia. (British representatives: E. R. Royston & Co., Tower Building, Water Street, Liverpool.)

Banbat. No. 465,586. Class 8. Radio-telephonic and telegraphic apparatus.—Prima Co., Ltd., 12, Commercial Street, Birmingham.

Onyx. No. 465,919. Class 8. Electric discharge tubes for radio and wired telegraphy and telephony, X-ray tubes, not employed for medical or surgical purposes, and rectifying tubes.—Mullard Radio Valve Co., Ltd., 45, Nightingale Lane, Balham, S.W.12.

Wandem. No. 466,247. All goods in Class 8.—Wainwright Manufacturing Co., Ltd., 531, Forest Road, Walthamstow, E.17.

G.P. (lettering and design). No. 462,607. Class 13. Electrical switches, contacts and terminals, electric-lighting fittings and accessories, fusible cut-outs, electric bells, junction boxes, ignition plugs, &c.—Gilbert Productions, Ltd., King's Road, Hay Mills, Birmingham.

Published Specifications.

Compiled expressly for this journal by Patent Agents.
The name of the applicant's patent agent, if any, will be found on the printed specification.
The numbers in parentheses are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken.

1924.

17,913. "Telegraphic signal amplification." K. L. Wood and Eastern Telegraph Co., Ltd. July 26th, 1924. (246,531.)

17,997. "Radio receiving stations." Dr. E. Asser. July 28th, 1923. (219,711.)

20,583. "Electrical transformers." Igranic Electric Co., Ltd., A. H. Curtis, S. R. Wright, and E. J. Brunning. September 1st, 1924. (Addition to 205,013.) (246,535.)

22,951. "Electrical discharge lamps." W. R. Bullimore. September 29th, 1924. (246,538.)

22,988. "Party-line telephones." E. F. Hastings. September 28th, 1923. (222,517.)

23,005. "Method of and means for composing and igniting the charges in internal-combustion engines." Daimler-Motoren Ges. September 28th, 1923. (222,519.)

23,910. "Inductance coil for electrical purposes, including wireless apparatus." L. E. L. Kelly. July 6th, 1925. (246,541.)

24,265. "Electrolysing fused baths." R. J. McNitt. October 30th, 1924. (246,542.)

25,021. "Two-way transmission systems, with repeaters, particularly for telephone lines." Standard Telephones & Cables, Ltd. (formerly Western Electric Co., Ltd.). (Western Electric Co., Inc.) October 21st, 1924. (246,544.)

25,032. "High-voltage electric transformers." S. Z. De Ferranti and Ferranti, Ltd. October 21st, 1924. (246,545.)

25,047. "Acoustic amplifiers." W. A. Darrah. October 21st, 1924. (246,546.)

25,297. "Automatic and semi-automatic telephone systems." Automatic Telephone Manufacturing Co., Ltd. (Automatic Electric Co.) October 23rd, 1924. (246,550.)

25,552. "Telephone receivers." Dubilier Condenser Co., Ltd. (formerly Dubilier Condenser Co. (1921), Ltd.). (A. Nyman.) October 27th, 1924. (246,556.)

25,559. "Electrical structures." Dubilier Condenser Co., Ltd. (formerly Dubilier Condenser Co. (1921), Ltd.). (W. Dubilier.) October 27th, 1924. (246,557.)

25,569. "Variable electric condensers." Dubilier Condenser Co., Ltd. (formerly Dubilier Condenser Co. (1921), Ltd.). (A. Nyman). October 27th, 1924. (246,558.)

25,570. "Electrical condensers." Dubilier Condenser Co., Ltd. (formerly Dubilier Condenser Co. (1921), Ltd.). (A. Nyman). October 27th, 1924 (246,559.)

25,574. "Variable electric condensers." Dubilier Condenser Co., Ltd. (formerly Dubilier Condenser Co. (1921), Ltd.). (W. Dubilier). October 27th, 1924. (246,560.)

25,634. "Magneto-electric machines." Fabrica Italiana Magneti Marelli. February 13th, 1924. (229,257.)

25,661. "Arc-welding process. E. Schroder. October 28th, 1924. (246,565.)

25,718. "Electrically-operated governors for controlling prime movers." Tilling-Stevens Motors, Ltd., and H. K. Whitehorn. October 28th, 1924. (246,572.)

25,766. "Relays for electric motor control and other purposes." Sir J. B. Henderson. October 29th, 1924. (246,573.)

25,776. "Headphones for wireless and other telegraphy and telephony." F. R. Johnston. October 29th, 1924. (246,574.)

25,839. "Electric switches." Simplex Conduits, Ltd., and H. F. McLoughlin. October 30th, 1924. (Cognate application 19,294/25.) (246,578.)

26,100. "Wireless systems." J. Robinson and N. Cox-Walker. November 1st, 1924. (246,592.)

26,249. "Electric switches." J. B. Tucker. November 4th, 1924. (246,595.)

26,528. "Electric-lamp holders and like couplings." J. C. White. November 6th, 1924. (Patent of addition not granted.) (246,599.)

27,211. "Electric-heating elements, particularly applicable to cooking apparatus." Falkirk Iron Co., Ltd., and J. Millar. November 14th, 1924. (246,604.)

27,270. "Battery chargers or rectifiers." Fansteel Products Co., Inc. March 27th, 1924. (231,423.)

27,308. "Rotary electric quick-release switches." Appareillage Gardy Soc. Anon. November 22nd, 1924. (225,209.)

27,698. "Vapour-electric rectifying apparatus." J. L. Rowbotham and Hewittic Electric Co., Ltd. November 19th, 1924. (246,614.)

27,701. "Vapour-electric rectifying apparatus." J. L. Rowbotham and Hewittic Electric Co., Ltd. November 19th, 1924. (246,615.)

28,213. "Electrical terminals." W. H. Bowling. November 25th, 1924. (246,619.)

28,719. "Package or carton applicable for packing thermionic valves or like articles having contact terminals." Radions, Ltd., H. J. Osborn, and G. D. G. Leadbetter. December 1st, 1924. (246,623.)

29,021. "Charging of electric storage batteries." Crypto Electrical Co., Ltd., and H. G. Sharp. December 3rd, 1924. (246,624.)

29,144. "Terminal caps for the carbon electrodes of dry batteries." A. H. Sheppard and Ever-Ready Co. (Great Britain), Ltd. December 4th, 1924. (246,625.)

29,607. "Electromagnetic sound-reproducing devices for telephony and like applications." S. Calamatianos. December 10th, 1924. (246,630.)

29,820. "Acoustic amplifiers or radiators." E. A. Graham. December 11th, 1924. (246,634.)

30,992. "Methods of cooling electric machines." A. W. Smith. December 24th, 1923. (226,831.)

31,379. "Apparatus for recording telephone messages." A. E. O'dell (Naamlooze Vennootschap Financieele Maatschappij Driebergen). December 31st, 1924. (246,646.)

1925.

612. "Connections or terminals for wireless and other electrical apparatus." E. A. Wood. January 8th, 1925. (Cognate application 3,734/25.) (246,648.)

1,025. "Electric motors." A. E. Alexander (Zobell Electric Motor Corporation). January 13th, 1925. (246,651.)

1,831. "Electric terminals." G. Edmonds, Ltd., and H. Edmonds. January 21st, 1925. (246,660.)

2,180. "Insulated electrical conductors and the like." Standard Telephones and Cables, Ltd. (formerly Western Electric Co., Ltd. (Western Electric Co., Inc.). January 24th, 1925. (246,663.)

3,035. "Plug switches." S. M. Hale. February 3rd, 1925. (246,669.)

6,209. "Electromagnet clocks." Soc. Anon. Etablissements L. Hatot. October 24th, 1924. (241,856.)

6,267. "Wireless telegraphy and telephony apparatus." J. Millet. March 7th, 1925. (246,686.)

7,745. "Telephone protector and disinfector." J. Cooney, Jun., and J. Cooney, Sen. March 23rd, 1925. (246,691.)

8,562. "Grips or glands for sheathed electric cables." A. Kirk and W. G. R. Ball. March 31st, 1925. (246,694.)

8,696. "Dynamo-electric machinery." A. Parkinson and Parkinson, Ltd., F. & A. April 1st, 1925. (246,695.)

9,143. "Electric steam generation." T. H. Noll. April 6th, 1925. (246,697.)

10,036. "Terminals of the plug-and-socket type." A. W. Whistlecroft. April 17th, 1925. (246,700.)

10,716. "Manufacture of electro-ionic discharge tubes." Edison Swan Electric Co., Ltd. April 28th, 1924. (232,978.)

11,132. "Contact device for electric illuminated advertising." H. O. Frederiksen and L. E. Rasmussen. April 29th, 1925. (246,702.)

13,312. "Illuminated signs." Patent-Treujand-Ges. für Elektrische Gluhlampen. June 16th, 1924. (235,544.)

13,650. "Automatic electric signalling apparatus for double-track railways." J. Kremenezky (firm of) and L. Wimberger. May 28th, 1924. (234,810.)

14,286. "Operating means for variable electric condensers, variometers, and like instruments." G. A. Laughton and F. J. Curry. June 2nd, 1925. (246,713.)

14,685. "Closing means for electrical-instrument cases." Soc. Génévoise d'Instruments de Physique. June 28th, 1924. (236,188.)

14,839. "Commutator brushes." R. L. Henry. June 8th, 1925. (246,716.)

16,780. "X-ray tubes." Naamlooze Vennootschap Philips' Gloeilampenfabrieken. April 6th, 1925. (246,723.)

17,749. "Electrical measuring instruments." Metropolitan-Vickers Electrical Co., Ltd. August 9th, 1924. (238,201.)

18,526. "Electrostatic telephones." Tri-Ergon Akt.-Ges. April 7th, 1925. (246,728.)

19,229. "Construction of electric switch." G. Marr. July 29th, 1925. (246,732.)

20,278. "Luminous signal circuits, particularly for railways." Siemens and Halske Akt.-Ges. and Dr. J. Arndt. August 12th, 1925. (246,739.)

20,285. "Portable electric safety lamps." J. G. Barber and I. R. Van Wart. August 12th, 1925. (246,740.)

21,624. "Electric ignition apparatus." Scintilla. August 28th, 1924. (239,230.)

22,572. "Electric water heaters." E. C. Steere. September 10th, 1925. (246,751.)

23,794. "Electrical precipitation apparatus." Lodge-Cottrell, Ltd., and N. Stallard (Metallbank und Metallurgische Ges. Akt.-Ges.). September 23rd, 1925. (Addition to 176,713.) (246,757.)

26,907. "Synchronous induction motors." British Thomson-Houston Co., Ltd. October 30th, 1924. (242,279.)

27,171. "Electric incandescent-lamp sockets." British Thomson-Houston Co., Ltd. November 3rd, 1924. (242,298.)

30,247. "Electromagnetic devices." Standard Telephones and Cables, Ltd. (formerly Western Electric Co., Ltd) (Western Electric Co., Inc.). September 1924. (Divided application on 243,787.) (246,711.)

31,425. "Automatic and semi-automatic telephone systems." Automatic Telephone Manufacturing Co., Ltd. (Automatic Electric Co.). October 23rd, 1924. (Divided application on 246,550.) (246,775.)

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Politics and Electricity.

ONCE again electricity measures have been caught in the whirlpool of politics. The London Power Company's Bill enabling it to build a station at Brentford, and the Metropolitan Company's Bill to extend its area, have both been rejected, not on their merits, but because of a fear that they would perhaps prejudice the work of the London Joint Authority, the suspicion of Socialists, and so forth. It is a lamentable thing that electricity development should become the subject of contention between rival political parties, and we sympathise with the Companies which have thus suffered a set-back. But companies, themselves, are not always entirely innocent of countenancing similar tactics; in fact, if our memory serves us, it was the West End Companies that started this particular hare—or if not, at least they joined in, in full cry. Mr. Attlee, in moving the rejection of the London Power Bill, seemed almost to be speaking from the West End Companies' own brief when they opposed the Barking station scheme some years ago, urging that no new station should be built before the Joint Authority's plans were fully matured, and that the site chosen was not a good one. Mr. Attlee said that "the Bill was a misguided attempt to get in first and queer the pitch of the larger scheme." We have an idea that, in substance, that was exactly what the West End Companies said at the Commissioners' inquiry about Barking. But we do not wish to press the point. We mention it merely because it points a moral—one that will be heeded in the future, when all the schemes require to be constantly dovetailed together. The moral is that all electrical parties themselves should deal with all matters on technical and commercial grounds, on their merits, and never invoke political issues or join forces, in a particular case, with political sections, especially when they violate their own principles by doing so.

It is to be regretted that the Metropolitan Electric Supply Company's Bill, which was warmly supported by the Minister of Transport, was not allowed to proceed. We fully recognise the right of the London and Home Counties Joint Electricity Authority to control electrical affairs within its District, but the Minister pointed out that the Company was willing to meet almost all the objections of the Authority, and stated his inten-

extraordinary rate, a cheaper line might be run. In a national scheme he assumed the pressure of transmission would be in the neighbourhood of from 110,000 to 120,000 volts. It would be better to have a Joint Authority representing a large area than five different authorities negotiating separately for supplies.

Mr. PEARCE was surprised that there was no diversity factor. Was there no difference between Stoke and Stafford?

Mr. ELLIS replied that they pretty well coincided, but he was not going to say that that would continue.

Mr. HERBERT asked that provision be made that if the Potteries Electric Traction Co. took a bulk supply, the company should not be required to pay more than it would cost to generate the supply itself.

Ald. G. P. DEAN, for the employés' side of the National Joint Industrial Council, suggested that the workers be allowed to have two representatives upon the Authority. Mr. W. A. JONES asked that there be one representative of the employés' side of the Joint Industrial Council and one representative of the employés' side of the District Joint Board.

Mr. CRAIG HENDERSON replied that at present the number of workers at the five stations did not exceed 60. When they got high-pressure main transmission and so on the number might go up to something like 100. One representative was sufficient. There was no objection to the working together of the two bodies representing the staff workers and the manual workers. The proposal put forward by the Potteries Electric Traction Co. amounted to asking that the amortisation charges for its present generating plant shall be borne by the Joint Electricity Authority.

The inquiry was then closed.

Trade-Mark Applications.

THE following are among the recent applications for British trade marks. Objections against any of the proposed marks may be entered within one month from February 17th :—

E.M.S. (lettering and design). No. 456,534. Class 6. Mechanical signs for advertising purposes. No. 456,535. Class 8. Electric batteries (not medical). No. 456,536. Class 13. Electric lamps (ordinary).—Electrical Name and Numerical Sign Co., Ltd., 30, Little Newport Street, Charing Cross Road, W.C.2.

Orion. No. 465,918. Class 6. Electric vacuum cleaning machines.—Electrical and Manufacturing Co., 7-13, Clavering Place, Newcastle-on-Tyne.

Radio Palabo, P.S.P.S. No. 465,906. Class 8. Instruments and apparatus for use in radio-telephony.—Pala. A. Spal, Slany, Czecho-Slowakia. (British representatives: E. R. Royston & Co., Tower Building, Water Street, Liverpool.)

Banbat. No. 465,586. Class 8. Radio-telephonic and telegraphic apparatus.—Prima Co., Ltd., 12, Commercial Street, Birmingham.

Onyx. No. 465,919. Class 8. Electric discharge tubes for radio and wired telegraphy and telephony, X-ray tubes, not employed for medical or surgical purposes, and rectifying tubes.—Mullard Radio Valve Co., Ltd., 45, Nightingale Lane, Balham, S.W.12.

Wandem. No. 466,247. All goods in Class 8.—Wainwright Manufacturing Co., Ltd., 531, Forest Road, Walthamstow, E.17.

G.P. (lettering and design). No. 462,607. Class 13. Electrical switches, contacts and terminals, electric-lighting fittings and accessories, fusible cutouts, electric bells, junction boxes, ignition plugs, &c.—Gilbert Productions, Ltd., King's Road, Hay Mills, Birmingham.

Published Specifications.

Compiled expressly for this journal by Patent Agents.
The name of the applicant's patent agent, if any, will be found on the printed specification.
The numbers in parentheses are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken.

1924.

17,913. "Telegraphic signal amplification." K. L. Wood and Eastern Telegraph Co., Ltd. July 26th, 1924. (246,531.)

17,997. "Radio receiving stations." Dr. E. Asser. July 28th, 1923. (219,711.)

20,583. "Electrical transformers." Igranic Electric Co., Ltd., A. H. Curtis, S. R. Wright, and E. J. Brunning. September 1st, 1924. (Addition to 205,013.) (246,535.)

22,951. "Electrical discharge lamps." W. R. Bullimore. September 29th, 1924. (246,538.)

22,988. "Party-line telephones." E. F. Hastings. September 28th, 1923. (222,517.)

23,005. "Method of and means for composing and igniting the charges in internal-combustion engines." Daimler-Motoren Ges. September 28th, 1923. (222,519.)

23,910. "Inductance coil for electrical purposes, including wireless apparatus." L. E. L. Kelly. July 6th, 1925. (246,541.)

24,265. "Electrolysing fused baths." R. J. McNitt. October 30th, 1924. (246,542.)

25,021. "Two-way transmission systems, with repeaters, particularly for telephon lines." Standard Telephones & Cables, Ltd. (formerly Western Electric Co., Ltd.). (Western Electric Co., Inc.) October 21st, 1924. (246,544.)

25,032. "High-voltage electric transformers." S. Z. De Ferranti and Ferranti, Ltd. October 21st, 1924. (246,545.)

25,047. "Acoustic amplifiers." W. A. Darrah. October 21st, 1924. (246,546.)

25,297. "Automatic and semi-automatic telephone systems." Automatic Telephone Manufacturing Co., Ltd. (Automatic Electric Co.) October 23rd, 1924. (246,550.)

25,552. "Telephone receivers." Dubilier Condenser Co., Ltd. (formerly Dubilier Condenser Co. (1921), Ltd.). (A. Nyman.) October 27th, 1924. (246,556.)

25,559. "Electrical structures." Dubilier Condenser Co., Ltd. (formerly Dubilier Condenser Co. (1921), Ltd.). (W. Dubilier.) October 27th, 1924. (246,557.)

25,569. "Variable electric condensers." Dubilier Condenser Co., Ltd. (formerly Dubilier Condenser Co. (1921), Ltd.). (A. Nyman). October 27th, 1924. (246,558.)

25,570. "Electrical condensers." Dubilier Condenser Co., Ltd. (formerly Dubilier Condenser Co. (1921), Ltd.). (A. Nyman). October 27th, 1924. (246,559.)

25,574. "Variable electric condensers." Dubilier Condenser Co., Ltd. (formerly Dubilier Condenser Co. (1921), Ltd.). (W. Dubilier). October 27th, 1924. (246,560.)

25,634. "Magneto-electric machines." Fabrica Italiana Magneti Marelli. February 13th, 1924. (229,257.)

25,661. "Arc-welding process. E. Schroder. October 28th, 1924. (246,565.)

25,718. "Electrically-operated governors for controlling prime movers." Tilling-Stevens Motors, Ltd., and H. K. Whitehorn. October 28th, 1924. (246,572.)

25,766. "Relays for electric motor control and other purposes." Sir J. B. Henderson. October 29th, 1924. (246,573.)

25,776. "Headphones for wireless and other telegraphy and telephony." F. R. Johnston. October 29th, 1924. (246,574.)

25,839. "Electric switches." Simplex Conduits, Ltd., and H. F. McLoughlin. October 30th, 1924. (Cognate application 19,294/25.) (246,578.)

26,160. "Wireless systems." J. Robinson and N. Cox-Walker. November 1st, 1924. (246,592.)

26,249. "Electric switches." J. B. Tucker. November 4th, 1924. (246,595.)

26,528. "Electric-lamp holders and like couplings." J. C. White. November 6th, 1924. (Patent of addition not granted.) (246,599.)

27,211. "Electric-heating elements, particularly applicable to cooking apparatus." Falkirk Iron Co., Ltd., and J. Millar. November 14th, 1924. (246,604.)

27,270. "Battery chargers or rectifiers." Fansteel Products Co., Inc. March 27th, 1924. (231,423.)

27,308. "Rotary electric quick-release switches." Appareillage Gardy Soc. Anon. November 22nd, 1923. (225,209.)

27,698. "Vapour-electric rectifying apparatus." J. L. Rowbotham and Hewittic Electric Co., Ltd. November 19th, 1924. (246,614.)

27,701. "Vapour-electric rectifying apparatus." J. L. Rowbotham and Hewittic Electric Co., Ltd. November 19th, 1924. (246,615.)

28,213. "Electrical terminals." W. H. Bowling. November 25th, 1924. (246,619.)

28,719. "Package or carton applicable for packing thermionic valves or like articles having contact terminals." Radions, Ltd., H. J. Osborn, and G. D. G. Leadbetter. December 1st, 1924. (246,623.)

29,021. "Charging of electric storage batteries." Crypto Electrical Co., Ltd., and H. G. Sharp. December 3rd, 1924. (246,624.)

29,144. "Terminal caps for the carbon electrodes of dry batteries." A. H. Sheppard and Ever-Ready Co. (Great Britain), Ltd. December 4th, 1924. (246,625.)

29,607. "Electromagnetic sound-reproducing devices for telephony and like applications." S. Calamatianos. December 10th, 1924. (246,630.)

29,820. "Acoustic amplifiers or radiators." E. A. Graham. December 11th, 1924. (246,634.)

30,992. "Methods of cooling electric machines." A. W. Smith. December 24th, 1923. (226,831.)

31,379. "Apparatus for recording telephone messages." A. E. O'dell (Naamlooze Vennootschap Financiele Maatschappij Driebergen). December 31st, 1924. (246,646.)

1925.

612. "Connections or terminals for wireless and other electrical apparatus." E. A. Wood. January 8th, 1925. (Cognate application 3,734/25.) (246,648.)

1,025. "Electric motors." A. E. Alexander (Zobell Electric Motor Corporation). January 13th, 1925. (246,651.)

1,831. "Electric terminals." G. Edmonds, Ltd., and H. Edmonds. January 21st, 1925. (246,660.)

2,180. "Insulated electrical conductors and the like." Standard Telephones and Cables, Ltd. (formerly Western Electric Co., Ltd. (Western Electric Co., Inc.). January 24th, 1925. (246,663.)

3,035. "Plug switches." S. M. Hale. February 3rd, 1925. (246,669.)

6,209. "Electromagnet clocks." Soc. Anon. Etablissements L. Hatot. October 24th, 1924. (241,856.)

6,287. "Wireless telegraphy and telephony apparatus." J. Millet. March 7th, 1925. (246,686.)

7,745. "Telephone protector and disinfector." J. Cooney, Jun., and J. Cooney, Sen. March 23rd, 1925. (246,691.)

8,562. "Grips or glands for sheathed electric cables." A. Kirk and W. G. R. Ball. March 31st, 1925. (246,694.)

8,696. "Dynamo-electric machinery." A. Parkinson and Parkinson, Ltd., F. & A. April 1st, 1925. (246,695.)

9,143. "Electric steam generation." T. H. Noll. April 6th, 1925. (246,697.)

10,036. "Terminals of the plug-and-socket type." A. W. Whistlecroft. April 17th, 1925. (246,700.)

10,716. "Manufacture of electro-ionic discharge tubes." Edison Swan Electric Co., Ltd. April 28th, 1924. (232,978.)

11,132. "Contact device for electric illuminated advertising." H. O. Frederiksen and L. E. Rasmussen. April 29th, 1925. (246,702.)

13,312. "Illuminated signs." Patent-Treujand-Ges. für Elektrische Gluhlampen. June 16th, 1924. (235,544.)

13,650. "Automatic electric signalling apparatus for double-track railways." J. Kremenezky (firm of) and L. Wimberger. May 28th, 1924. (234,810.)

14,286. "Operating means for variable electric condensers, variometers, and like instruments." G. A. Laughton and F. J. Curry. June 2nd, 1925. (246,713.)

14,685. "Closing means for electrical-instrument cases." Soc. Génévoise d'Instruments de Physique. June 28th, 1924. (236,188.)

14,839. "Commutator brushes." R. L. Henry. June 8th, 1925. (246,716.)

16,780. "X-ray tubes." Naamlooze Vennootschap Philips' Gloeilampenfabrieken. April 6th, 1925. (246,723.)

17,749. "Electrical measuring instruments." Metropolitan-Vickers Electrical Co., Ltd. August 9th, 1924. (238,201.)

18,526. "Electrostatic telephones." Tri-Ergon Akt.-Ges. April 7th, 1925. (246,728.)

19,229. "Construction of electric switch." G. Marr. July 29th, 1925. (246,732.)

20,278. "Luminous signal circuits, particularly for railways." Siemens and Halske Akt.-Ges. and Dr. J. Arndt. August 12th, 1925. (246,739.)

20,285. "Portable electric safety lamps." J. G. Barber and I. R. Van Wart. August 12th, 1925. (246,749.)

21,624. "Electric ignition apparatus." Scintilla. August 28th, 1924. (239,230.)

22,572. "Electric water heaters." E. C. Steere. September 10th, 1925. (246,751.)

23,794. "Electrical precipitation apparatus." Lodge-Cottrell, Ltd., and N. Stallard (Metallbank und Metallurgische Ges. Akt.-Ges.). September 23rd, 1925. (Addition to 176,713.) (246,757.)

26,907. "Synchronous induction motors." British Thomson-Houston Co., Ltd. October 30th, 1924. (242,279.)

27,171. "Electric incandescent-lamp sockets." British Thomson-Houston Co., Ltd. November 3rd, 1924. (242,298.)

30,247. "Electromagnetic devices." Standard Telephones and Cables, Ltd. (formerly Western Electric Co., Ltd) (Western Electric Co., Inc.). September 1924. (Divided application on 243,787.) (246,711.)

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